

INFORMATION
ONLY

ROCKY FLATS ENVIRONMENTAL	Manual No.:	RFP/ERM-94-00019
TECHNOLOGY SITE	Section No.	Table of Contents, R1
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ACCIDENT PREVENTION SAFETY	Effective Date:	1/12/95
PROGRAM PLAN INT. OPER. UNITS	Organization:	Environmental Restoration Mgmt

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ACCIDENT PREVENTION SAFETY PROGRAM PLAN
INTEGRATED OPERABLE UNITS**

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DOCUMENT CLASSIFICATION...
PER R.B. HOFFMAN, CLASSIFICATION OFFICER
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8. Item	9. Page	10. Step	11. Proposed Modifications
1	2-2	F2-1	Change names as shown on revised F2-1. OU9 Project Manager is John Zimmerman, Field Team Leader is Simon Bell, H&S Coordinator is Lisa Nelowet, OU14 Project Manager is Bill Fieselman, HSS's are David Spruce, Tom Waddel.
2	Sec. 6 p.4	6.3	Delete 1st two sentences of Personal Sampling paragraph. Modify third sentence to read as follows "Personal sampling will be conducted only when Level C action levels are reached with direct reading instruments or when otherwise noted in Appendix A."
3	Sec. 6 p.7	6.4.4	Insert new first sentence: "Personal sampling will only be performed when directed to by EG&G Radiological Engineering."
4	Sec. 6 p.8	6.4.6	Insert new first sentence: "Ambient air sampling for airborne alpha radioactivity will only be performed when directed to by EG&G Radiological Engineering or if action levels for dust are exceeded in an RCA."
5	Sec. 5 p. 42	5.5.9.1	Delete the word "strenuous" from the first sentence of "Heat Stress Monitoring and Work Cycle management." Delete "even if workers are not wearing impervious clothing." Delete "and body water loss" from 2nd paragraph under "Heat Stress Monitoring . . ." Change "oral temperature" to "oral or ear canal temperature."
6	Sec 6 p. 3	6.3	Delete paragraph 6, " The fact that contaminants are listed . . ."

12. Justification (Reason for Modification, EJO#, TP#, etc.) Incorporating changes to improve compliance with 29CFR1910.120, and reflect current personnel and site conditions.
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If modification is for a new procedure or a revision, list concurring disciplines in Block 13, and enter N/A in Blocks 14 and 15. If modification is for any type of change or a cancellation, organizations are listed in Block 13, then Concuror print, and signs in Block 14, and dates in Block 15.

13. Organization	14. Print and Sign (if applicable)	15. Date (if applicable)
EOM	K. D. Anderson <i>[Signature]</i>	12/22/94
RE	D. Hyder <i>[Signature]</i>	12/22/94
IH	M. D. Schreckengast <i>[Signature]</i>	1/3/95
IA OU	B. D. Peterman <i>[Signature]</i>	12/22/94
OH	R. S. Linder <i>[Signature]</i>	1/9/95

16. Originator's Supervisor (print, sign, date) Bruce D. Peterman <i>[Signature]</i> 12/22/94	17. Assigned SME/Phone/Page/Location Craig Cowdery/6953/5466/080 <i>[Signature]</i>	18. Cost Center 3113	19. Charge Number 98903600	20. Requested Completion Date 1/1/95	21. Effective Date 1/12/95
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25. 95-DMR-ERM-0004
DMR. No. 94-DMR
Jan 17/95

2. or 3. Document Number/Revision RFP/ERM-94-00019			3. Document Title Integrated Operable Units, Health & Safety Plan
8. Item	9. Page	10. Step	11. Proposed Modifications
7	Sec. 9 p.2	9.1.1	Change "dispose of glove" to "dispose of outer gloves" Add bullet after "Remove respirator bullet" to read "Remove and dispose of inner gloves."
8	Sec. 8 p.2	8.1.1	Change first paragraph to read "For activities to be conducted under this plan, personnel will wear Level D as defined in Section 8.1.3." Delete paragraphs 2 and 3
9	Sec. 8 p.5	8.1.3	Add bullet after dosimeter badge bullet to read "nitrile gloves if hand contact with potentially contaminated materials is likely."
10	Sec. 5 p.14	5.2.2	Integrate new chemicals as shown into Section 5.2.2 alphabetically.
11	Sec. 5 p.2	5.2 Table 5-1	Integrate new chemicals as shown into Table 5-1 chemical Exposure Hazard Summary alphabetically.
12	Sec. 5 p.38	5.5.3	Change "Utility clearance will be completed before work begins..." to "Utility clearance will be completed by the client before work begins...."
13	Sec. 5 p.38	5.5.3	Change (SOP 7.7) to read SOP 7.7a
14	Sec. 5 p.38	5.5.3	Delete "which uses hand-augering to confirm the absence of buried utilities," Change the last sentence to read "A copy of Jacobs' SOP 7.7a is provided in Appendix C"
15	Appendix C	SOP 7.7	Delete SOP 7.7, add new SOP 7.7a Utility Clearance at Rocky Flats Plan (7 pages).
16	Sec. 7 p.4	7.1.5	The fourth bullet will read as follows: "All visitors will receive a site specific safety briefing, and will be escorted at all times. Visitors in areas requiring Level A, B or C PPE must have the equivalent training and PPE as the onsite worker to gain entry."
17	Sec. 7 p.4	7.1.5	Add bullet after above statement that reads, "Visitors in areas requiring Level D PPE must have Level D PPE, receive a site specific safety briefing, and will be escorted at all times."
18	Sec. 7 p.4	7.1.5	Add paragraph/sentence after "All site visitor access must be clearly documented..." bullet to read "If visitor does not supply current documentation but insists that he/she enters area, the following actions are to be taken:"
19	Sec. 7 p.4	7.1.5	Add bullet after above new statement to read, "On site HSS or HSST will shut down activities, secure area by monitoring with instrumentation, and contact HSO/HSS or Site Manager."
20	Sec. 7 pg.5	7.2	In first sentence delete "heavy equipment or"
21	Sec. 6 p.4	6.3	Add new text to end of <u>Action Levels</u> paragraph: <u>When</u> action levels are reached which, according to Appendix A, require "evacuation and reevaluation," site workers must move to an area where direct reading instrumentation shows airborne concentrations are below the action levels of concern. The HSS/HSST must contact the Health & Safety Coordinator to determine further action.

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DMR. No. ~~94-DMR~~ Jan 1/9/95

2. Document Number/Revision
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3. Document Title
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8. Item	9. Page	10. Step	11. Proposed Modifications
22	Sec. 6 p. 2	6.3	Add to end of 1st paragraph: "All monitoring will be in the breathing zone unless otherwise specified in Appendix A."
23	Sec. 10 p. 2	10.2.1	Add EG&G Operations Manager Representative. Change "Kent Mahana" to "Lisa Nelowet."
24	Sec. 10 p. 3	10.2.1	Add EG&G Operations Manager Representative.
25	Sec. 10 p. 8	10.3.1	Add Operations Manager Representative, as listed in Tables 10-1, 10-2, must be notified of any unplanned releases.
26	Sec. 10 p. 9	10.3.2	Change "Kent Mahana" to "Lisa Nelowet"
27	Sec. 5 p. 5-31	T5-4	Modify as shown.
28	Sec. 6 p. 3	6.3	Replace "every 15 minutes" to "whenever site conditions change" in first paragraph.
29		F7-1	Delete figure
30	Sec. 7 p. 5	7.2.1	Delete 1st sentence.

12. Justification (Reason for Modification, EJO#, TP#, etc.)

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APPENDIX C Jacobs Engineering Group Standard Operating Procedures

LIST OF EFFECTIVE PAGES

<u>Pages</u>	<u>Effective Pages</u>	<u>Change Number</u>
TOC: viii	1/12/95	95-DMR-ERM-0004
Section 5: 1-59	1/12/95	95-DMR-ERM-0004
Section 6: 2-4, 7-8	1/12/95	95-DMR-ERM-0004
Section 7: 4-5	1/12/95	95-DMR-ERM-0004
Section 8: 2, 5	1/12/95	95-DMR-ERM-0004
Section 9: 2	1/12/95	95-DMR-ERM-0004
Section 10: 2-3, 8-9	1/12/95	95-DMR-ERM-0004
Appendix C: SOP 7.7a	1/12/95	95-DMR-ERM-0004

2.0 HEALTH AND SAFETY PERSONNEL

2.1 INTRODUCTION

This section identifies personnel responsibilities for the management and implementation of this HSP. An organization chart that includes health and safety personnel for the project is shown in Figure 2-1.

2.1.1 Corporate Health and Safety Officer

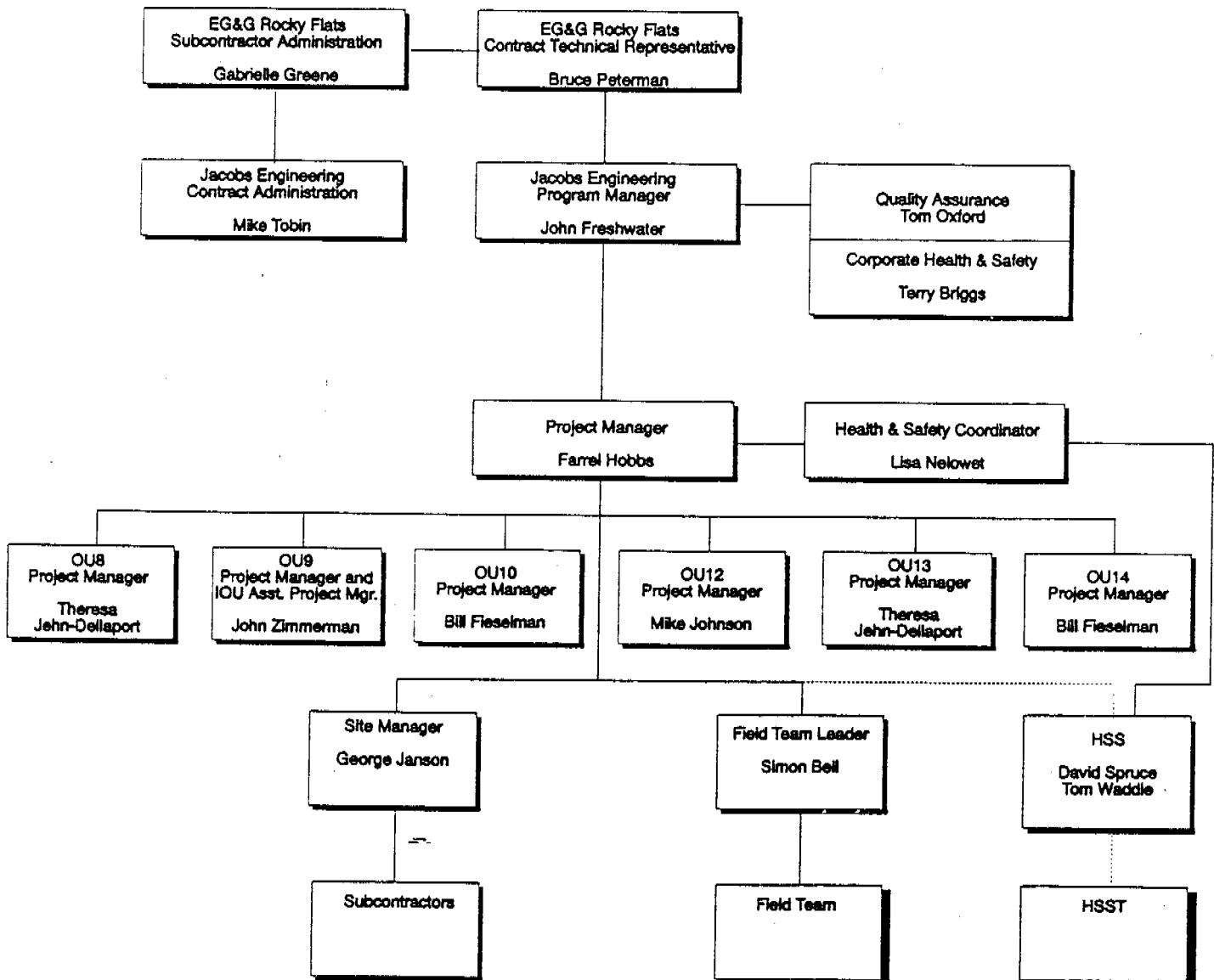
The CHSO will provide oversight and review of activities conducted under this plan. The CHSO will (1) review and approve significant changes and modifications to this plan, (2) conduct audits on a periodic basis to ensure that the practices and procedures contained within this HSP are properly implemented, (3) provide technical guidance as required, (4) provide medical surveillance and health and safety records to the Health and Safety Coordinator, and (5) provide final resolution for health and safety issues.

2.1.2 Health and Safety Coordinator

The Health and Safety Coordinator is responsible for ensuring that the policies and procedures of this HSP are implemented. This responsibility includes making certain that all personnel designated to work are qualified according to medical surveillance and health and safety training consistent with Occupational Safety and Health Administration (OSHA) 29 CFR 1910.120, DOE Order 5480.11, and EG&G site-specific training. Any significant changes to the HSP must be approved by the Health and Safety Coordinator. The Health and Safety Coordinator will investigate serious accidents that occur onsite to determine fundamental causes and actions to be taken to prevent recurrence. The Health and Safety Coordinator will (1) review and approve the HSP; (2) ensure that all subcontractors comply with the specifications of this plan; (3) assist in planning, coordinating, and implementing project health and safety operations and services;

FIGURE 2-1

INTEGRATED OU PROJECT ORGANIZATION CHART
ROCKY FLATS PLANT



95-DNR-ER 0004

INFORMATION ONLY

Approved By:

15/ 1 1
Director (Date)

15/ 1 1
Project Manager (Date)

Health and Safety Plan,
Integrated Area Operable Units

15/ 1 1
Quality Assurance Program Manager (Date)

5.0 HAZARD EVALUATION

5.1 INTRODUCTION

The activities covered by this HSP present potential chemical, physical, radiological, and biological exposure hazards, which may be encountered during the conduct of work at RFP. If intrusive activities are to be conducted, an addendum to this HSP will be generated using information obtained from stage one of this investigation. The evaluation is based on the work plans for the OUs and the *Historical Release Report*.

5.2 HAZARD ASSESSMENT

The potential hazards for chemicals of concern are discussed in this section. These chemicals are located primarily within the soils, pipes, and tanks in the areas to be investigated. The historical records and work plans associated with this investigation provided little quantitative data regarding concentrations of chemicals or radionuclides in the soils or the surrounding atmosphere.

A summary of suspected contaminants of concern along with OSHA and American Conference of Government Industrial Hygienists (ACGIH) exposure limits for each contaminant of concern are presented in Table 5-1. If future potential contaminants are identified, National Institute of

Chemical	MSHA PEL	ACGIH TLV	NIOSH REL	STEL	GEN.ING.	IDLH	SKIN IRRITATION	CORROSIVE	BOILING POINT (°F)	VAPOR PRESSURE (mm Hg)	FLASH POINT (°F)	UEL (%)	LEL (%)	°D
Acetic Acid	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	544	1 mm @ 285°F	N/A	N/A	N/A	N/A
Acetic Anhydride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	244	1 mm @ 200°F	102	19.8 @ 200°F	4.0	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	133	1 mm @ 180	0	13	2.5	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	2,450	1 mm @ 1,284 °F	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	Decomposes (275)	> 1 mm @ 86°F	N/A	28%	15%	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	-28		N/A	-	-	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	Sublimates	0	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	4,332	0	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	1,408	0	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	N/A	0	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	3,098 (Decomposes)	0	N/A	28%	15%	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	116	287	-22	50	1.3	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	170	91	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	205	1 mm @ 270	N/A	15.4%	3.8%	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	143	21 atm	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	Varies	Varies	Varies	Varies	Varies	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	Varies	Varies	Varies	Varies	Varies	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	Decomposes	N/A	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	4,786	0	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	4,703	0	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	2,725	0	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	177	64 mm @ 277°F	0	5%	1.3%	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	350-860	1	> 125	7.5	0.6	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	107°C	0	111°C	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	3,098	0	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	309.2	0	-122	6	1.3	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	-121	> 1 atm	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	67	> 1 atm	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	266	N/A	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	385	3.3 @ 277°F	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	N/A	0	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	3,184	0	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	3,162	0	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	1,350	1 mm @ 587°F	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	Decomposes	1 mm @ 727°F	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	1,317	Varies	Varies	Varies	-	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	-	-	-	-	-	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	474	0.0012 mm	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	143	160	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	88-460	48	40-68	5.9	1.1	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	5,139	0 mm	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	5,139	0	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	Varies	Varies	Varies	Varies	Varies	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	181	48	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	N/A	10°	11 mm	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	N/A	N/A	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	415	0.03	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	888-734	8 to 10-3	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	N/A	N/A	N/A	N/A	N/A	N/A
Acetic Chloride	1 mg/m ³	1 mg/m ³	10 ppm	15 ppm		60 mg/m ³		X	1,320	-	-	-	-	N/A

TABLE 5-1

• Xylene •

Boilers	(C)	(A)	(P)
Boiling Pt (°F)	202	206	281
Flash Pt (°F)	63	64	81
Water Pressure	7 mm	8 mm	8 mm
LEL %	1.1	1.6	1.5

Occupational Safety and Health (NIOSH) Recommended Exposure Levels will be used if ACGIH or OSHA standards are unavailable. Table 5-2 presents the location of each IHSS, the event leading to potential contamination, and the suspected contaminants at each site. Radionuclides are presented in Table 5-3.

5.2.1 Dust Hazard

Dust can be an inhalation hazard and an eye irritant for fieldworkers. The main chemicals in dust during operations will be airborne particulates contaminated with light and heavy metals, and radionuclides.

Light and heavy metals may be present in the soil. Soil brought to the surface during sampling may be sufficiently dry for particulates to become suspended in the air and create a respiratory hazard. Due to undefined contaminant concentrations, misting will be used for dust control when soil is disturbed and dust is recorded above background using a Mini-ram. Misting will also be applied to surface sediment around the site location if blowing dust occurs. If winds exceed 35 miles per hour, field operations will be shut down.

5.2.2 Chemicals of Concern

The chemicals of concern are associated with the events leading to the potential contamination of each site under investigation. Because work being conducted at RFP involves the initial characterization of these sites, quantitative data regarding anticipated concentrations are not available.

Following is a discussion of each suspected inorganic, volatile organic, and semivolatile organic compound. Properties reflect those associated with the chemicals in a concentrated form. It is not expected that concentrated forms will be encountered during the project.

TABLE 5-2
INTEGRATED OPERABLE UNIT
LOCATION AND HAZARD SUMMARY BY INDIVIDUAL HAZARDOUS SUBSTANCE SITES

OU	IHSS	LOCATION	DESCRIPTION
8	118.1	West of Building 730.	A 20- by 40-foot area near a former UST, containing carbon tetrachloride or trichloroethane west of Building 730.
8	118.2	South end of Building 776.	A 20- by 30-foot area between Buildings 707 and 778, a carbon tetrachloride spill.
8	123.1	Valve Vault 7 southwest of Building 707.	A 40- by 40-foot area south of Sage Avenue and west of North Street. A process wastewater spill containing uranium, solvents, oils, beryllium, nitric acid, hydrochloric acid, and fluoride.
8	135	Cooling Tower Blowdown northeast of Building 374.	A 115- by 40- by 50-foot area northeast of Building 374. Possible tritium, phosphate compounds, and chromate contamination from cooling tower blowdown water.
8	137	Cooling Tower Blowdown Buildings 712 and 713.	A 10-foot-wide zone beyond the foundations of Buildings 712 and 713, possible chromium contamination from cooling tower blowdown water.
8	138	Cooling Tower Blowdown near Building 779.	A 50- by 50-foot area north of Building 727. A pipe leak and effluent spill toward trench 6, possible total chromium, radiation activity, and inorganic phosphates.
8	139.1 (North and South)	Hydroxide Tank Area Buildings 771 and 774.	NaOH steam condensate tanks and KOH tank, possible chromium and 3,000 dpm/l alpha activity.
8	139.2	Hydrofluoric Acid Tank Area - Building 174.	Possible spill from horizontal, 1,300-pound hydrofluoric acid cylinders.
8	144 (North and South)	Sewer Line Breaks near Building 730, Tanks 776 A-D.	Four underground waste holding tanks north of Building 776 and east of Building 701A. Possible elevated radioactivity.
8	150.1	Radioactive site north of Building 771.	Radioactive waste leaks north of Buildings 771 and 776.
8	150.2	Radioactive site west of Buildings 771 and 776.	From the 1957 fire in Building 771. Water from the fire fighting, radioactive contaminated soil west of Building 771 (plutonium).
8	150.3	Radioactive site west of Buildings 771 and 774.	Radioactive leak from process waste lines into a tunnel that connects Buildings 771 and 774, could have also contained nitrates and other chemical contaminants.
8	150.4	Radioactive site east of Building 750.	Leaking process waste line near a sump located outside of Door 3 south of Building 778. There is a possibility that equipment was decontaminated in the area after a 1969 fire.

TABLE 5-2 INTEGRATED OPERABLE UNIT LOCATION AND HAZARD SUMMARY BY INDIVIDUAL HAZARDOUS SUBSTANCE SITES			
OU	IHSS	LOCATION	DESCRIPTION
8	150.8	Radioactive site northeast of Building 779.	An improperly opened, radioactively-contaminated waste drum was spread by pedestrian tracking.
8	150.7	Radioactive site south of Building 776.	From 1969 fire, plutonium tracked outside of Building 776 by fire fighters.
8	150.6	Radioactive site south of Building 779.	Contaminated oil from a cut-apart drum was tracked by pedestrians to the first floor dock and surrounding outdoor areas south and east of Building 779.
8	151	Fuel oil leak - Tank 262 north of Building 374.	UST No. 2 diesel fuel oil a 45- by 60-foot area centered over tank.
8	163.1	Radioactive site north of Building 774.	A 50- by 125-foot area northwest of Building 774. Reportedly, area used to wash radioactive contaminated vehicles.
8	163.2	Radioactive site north of Buildings 771 and 774.	An 8- by 8-foot slab buried near Building 771A. Slab used as a foundation for a 5,000-gallon stainless-steel tank used in the filtrate recovery ion exchange system, slab was contaminated with americium.
8	172	Central Avenue Waste Spill.	Approximately 1 mile of Central Avenue from 903 Pad to Building 771. A drum of contaminated lathe coolant leaked during its transport to the waste treatment facility. Possibly carbon tetrachloride, machine cutting oil, perchloroethylene, uranium, and plutonium.
8	173	Radioactive site 900 Area. Dock area, Building 991.	Activities at the dock included cleaning of depleted uranium parts with acetone, perchloroethene, and trichloroethane.
8	184	Radioactive site Building 991 steam cleaning area (near Building 992).	A 55- by 75-foot area located south of Building 991 used to steam clean radioactively contaminated equipment and drums.
8	188	Acid leak. The southeast corner of Building 374.	A 55-gallon drum containing nitric and hydrochloric acid leaked. The mixture was suspected to be a waste leaching solution originating from the 400 Area that may have contained trace heavy metals.

TABLE 5-2 INTEGRATED OPERABLE UNIT LOCATION AND HAZARD SUMMARY BY INDIVIDUAL HAZARDOUS SUBSTANCE SITES			
OU	IHSS	LOCATION	DESCRIPTION
9	121	Original Process Waste Line (OPWL). A network of pipelines and tanks that extends throughout much of the RFP main production complex. It comprises 35,000 feet of underground pipelines and 39 tank locations for a total of 65 tanks.	Used to temporarily store and transport process wastes to onsite treatment and discharge points. Potential contaminants include uranium 238 and 235, plutonium, nitrate, acids, bases, hexavalent chromium, beryllium, iron, iodine, phosphate, tritium.
9	122	Underground storage tanks south of Building 441.	Tanks stored process waste from Buildings 441 and 123. Nitrates and radionuclides would be present.
9	123.2	Valve vault west of Building 707.	A liquid release containing uranium, solvents, oil, beryllium, nitric and hydrochloric acids, and fluoride.
9	124.1 and 124.3	Three tanks east of Building 774.	A release of process wastewater, high in nitrate and contaminated with plutonium and uranium.
9	125	Holding tank east of Building 774.	A release of process wastewater, high in nitrate and contaminated with plutonium and possibly uranium.
9	126.1 and 126.2	Out-of-service process waste tanks in Building 728.	A release of liquid process wastes contaminated with nitrate, plutonium, uranium, and various other organic and inorganic constituents.
9	127	Process waste line between Building 774 and the sanitary wastewater treatment plant.	Numerous line breaks. The waste is characterized by high nitrate levels with plutonium contamination.
9	132	Underground storage tanks under Building 730.	Leaking underground storage tanks, containing mostly water with small amounts of detergent and radionuclides.
9	146.1 and 146.6	Six underground concrete process waste holding tanks south of the original Building 774.	The process waste stored in the tanks was an aqueous solution with plutonium, uranium, acids, and caustics.
9	147.1	Process waste line north of Building 881.	High nitrate levels, uranium, plutonium, beryllium, acids, and solvents.

TABLE 5-2
INTEGRATED OPERABLE UNIT
LOCATION AND HAZARD SUMMARY BY INDIVIDUAL HAZARDOUS SUBSTANCE SITES

OU	IHSS	LOCATION	DESCRIPTION
10	182	An approximate 1,700-square-foot area between Buildings 444 and 453.	A drum storage area. Drums contained waste hydraulic oils and chlorinated solvents. Beryllium and low-level depleted uranium oxide waste contamination present in some of the waste.
10	205	Outside of Building 460, along southeast corner of the building.	Portable cylindrical vessels used to collect waste nitric acid hydrofluoric acid and ammonium salts.
10	206	East side of Building 374.	Area where an 8-foot-diameter by 49.5-foot-long steel storage tank was located. Tank stored off-specification Building 374 product water. Water contained low concentrations of tritium.
10	207	A 9.5- by 9-foot area at the east side of Building 444.	Bermed area that contained acid waste dumpsters. Acids were a mixture of phosphoric acid, sulfuric acid, and chromium trioxide. Waste acid contained cyanide, cadmium, chromium, lead, silver, arsenic, uranium, americium, and tritium contamination. Dumpsters have been removed.
10	208	Approximately 30 feet west of Building 453.	An 8- by 20-foot cargo container. Wastes stored were a composite of nitric acid with silver, sodium fluoride, sodium fluoride solution, plating acids (hydrochloric, nitric, and hydrofluoric) with chromium plating solution, cadmium cyanide solution, nickel sulfate, developer, and fixer.
10	210	South of Spruce Avenue and east of 10th Street, approximately 40 feet south of Building 980.	An 8- by 20-foot cargo container and adjacent 20- by 20-foot area used to store drums of waste auto oil, solvents, paints, thinner, grease, gasoline, diesel fuel, and fiberglass resins and catalysts.
10	213	Southeastern portion of the production area.	A 439- by 295-foot area covered with asphalt. Used to store pondcrete: a mixture of Solar Evaporation Pond sludge and sediment with portland cement. Potential contamination by nitrate, low-level radiation, and VOCs.
10	214	Approximately 90 feet east of Building 750.	A 142,000-square-foot area covered with asphalt. Used to store pondcrete: a mixture of Solar Evaporation Pond sludge and sediment with portland cement. Solidified low-level radioactive and hazardous wastes.
12	116.1	West Loading Dock Building 447.	Spills and leaks from oil stored in drums. Suspected solvents and hydrocarbons may also be low-level radioactive materials.
12	116.2	South Loading Dock Building 444.	Many incidents of drum leaks and spills. Contaminants include uranium, uranium oxide, tetrachloride, nitric acid, chlorinated hydrocarbon solvents, and beryllium. Beryllium soil concentrations range from 350 to 1,000 µg/g. Direct uranium activity readings were recorded as high as 7,500 dpm. Direct uranium air counts have been recorded as high as 1,372 dpm.

TABLE 5-2
INTEGRATED OPERABLE UNIT
LOCATION AND HAZARD SUMMARY BY INDIVIDUAL HAZARDOUS SUBSTANCE SITES

OU	IHSS	LOCATION	DESCRIPTION
12	136.1 and 136.2	Cooling Tower Pond east of Building 444.	For collection of solutions used to clean the cooling towers, reportedly acidic or lithium dichromate, lithium chromate, and hexavalent chromium. Small amounts of depleted uranium may have been buried here as well.
12	147.2	Building 881 Conversion Activity.	Storage of miscellaneous equipment. Possible contamination from beryllium and/or depleted uranium.
12	157.2	Radioactive site south area Building 444, 447, 440 and 439.	Several incidents of spills and fires, contaminated soils around these buildings, including depleted and enriched uranium, beryllium, chlorinated hydrocarbon solvents, including carbon tetrachloride, hydraulic oil, lithium, and chromium.
12	187	Sulfuric Acid Spill east of Building 4433.	1,500 gallons of 94% sulfuric acid spilled from an aboveground storage tank. 32,000 pounds of lime were added to neutralize the acid. In addition, 200 additional gallons went to the sewer system.
12	120.1	Fiberglassing Areas north of Building 664.	Spills of polyester resin peroxide catalyst materials and unspecified cleaning solvents. Higher than background levels of gamma radiation from plutonium, uranium, and americium have been detected.
12	120.2	Fiberglassing Area west of Building 664.	Potential residue from spills of polyester resin peroxide catalyst and unspecified cleaning solvents. Higher than background levels of radiation from plutonium and uranium.
12	189	Nitric Acid Tanks north and west of Building 881.	Three nitric acid spills. Two of the spills were neutralized with sodium bicarbonate.
12	147.2	Building 881 Conversion Activity, 150 feet south of Building 865, 250 feet east of Building 883, and 450 feet south of Central Avenue.	Storage of equipment during conversion process; beryllium and enriched or depleted uranium.
13	117.1	North Chemical Storage Site, northeast of Building 552, west of Building 559.	Buried nonradioactive material including aluminum machine turnings, rings, shapes, overlays and other metal parts contaminated with uranium chips.
13	117.2	Middle Chemical Storage Site, east of Building 551.	Multipurpose storage, including acids, soaps, solvents, beryllium chips and turnings, drums of aluminum scraps, and drums of aluminum nitrate. Monitoring indicated occasional buildup of radioactivity.

TABLE 5-2 INTEGRATED OPERABLE UNIT LOCATION AND HAZARD SUMMARY BY INDIVIDUAL HAZARDOUS SUBSTANCE SITES			
OU	IHSS	LOCATION	DESCRIPTION
13	117.3	South Chemical Storage Site, southwest corner of Central Avenue and Seventh Street.	A wooden waste box, containing a glovebox, leaked contaminated oil, probably plutonium contaminated.
13	128	Oil Burn Pit No. 1 Waste Leak, north of Building 335.	Experimental oil burning in a pit now buried. Reportedly, there are 200 gallons of suspected perchloroethene containing depleted uranium.
13	134	Lithium Metal Destruction Site, beneath an eastern addition of Building 331 and Sage Avenue.	Waste lithium mixed with machinery oils was burned in 55-gallon drums for fire department training. Sodium, calcium solvent-type chemical compounds, graphite, and magnesium may also have been present.
13	148	Waste spills outside of Building 123.	Small spills of nitrate-bearing wastes. Leaks from process waste lines. Possible low-level radioactive wastes, with nitrates.
13	152	Fuel Oil Tank east of Building 452.	No. 6 fuel oil spills and leaks.
13	157.1	North Area Radioactive Site, Building 444.	Leak or spills from laundry operations, levels of radioactivity in soils range from 1.8×10^4 to 5.2×10^5 dpm/kg. Contaminants include depleted uranium, enriched uranium, beryllium, and solvents.
13	158	Building 551 Radioactive Site.	Laundry dock, storage area for offsite shipment by train. Low-level radioactive contamination, from uranium.
13	169	Waste Peroxide Drum Burial, Chemical Storage Area east of Building 551.	Spill of 35% hydrogen peroxide.
13	171	Solvent Burning Ground east of Building 335.	Diesel fuel and gasoline burned and extinguished for training purposes, magnesium may also be present. Waste solvents may also have been present.
13	186	Valve Vault west of Building 552.	Pipe leak - uranium, nitrate, plutonium, americium, chloride, sulfate, oakite.
13	190	Caustic Leak southeast corner of Building 443.	A 1,500-gallon sodium hydroxide spill.
13	191	Hydrogen Peroxide Spill. Near intersection of Fifth Street and Central Avenue.	Two 55-gallon drums of 35% hydrogen peroxide fell from a pallet.

TABLE 5-2 INTEGRATED OPERABLE UNIT LOCATION AND HAZARD SUMMARY BY INDIVIDUAL HAZARDOUS SUBSTANCE SITES			
OU	IHSS	LOCATION	DESCRIPTION
14	131	Radioactive Site 700 Area Site No. 1, Building 776 gas bottle dock.	Explosion that released plutonium.
14	156.1	Radioactive Site Building 334 Parking Lot.	Contaminated soil pile - subsequently removed. Before removal, soil samples were 3 to 704 dpm/g.
14	160	Radioactive Site Building 444 Parking Lot.	Storage area for punctured or leaking waste drums and boxes. Uranium, plutonium, PCBs, tetrachloroethylene, carbon disulfide, and 1,1,1-trichloroethane.
14	161	Radioactive Site Area west of Building 664.	Punctured or leaking drums and boxes. Americium-241, plutonium, uranium, hydraulic oil, tetrachloroethylene, other volatile organics.
14	162	Radioactive Site 700 Area Site No. 2 south of Building 771.	Unknown source - volatile organics, radionuclides, beryllium, iron, chromium, hexavalent chromium, nitric acid, hydrochloric acid, and fluoride.
14	164.1	Radioactive Site 800 Area, No. 2. Concrete Slab, northwest Building 881.	Storage of a plutonium-contaminated slab.
14	164.2	Radioactive Site 800 Area, Site No. 2 Building 886 Spills.	Spills as a result of movement of contaminated equipment and other activities. Accumulated groundwater in pit is likely uranium contaminated.
14	164.3	Radioactive Site 800 Area Site No. 2 Buildings 889 Storage.	Decontamination facility for uranium-contaminated equipment.

NOTES: dpm = disintegrations per minute per gram
g = gram

IHSS = Individual Hazardous Substance Site

kg = kilogram

KOH = potassium hydroxide

l = liter

NaOH = sodium hydroxide

OU = Operable Unit

PCB = polychlorinated biphenyls

PVC = polyvinyl chloride

RFP = Rocky Flats Plant

UST = underground storage tank

VOCs = volatile organic compounds

µg/g = micrograms per gram

% = percent

TABLE 5-3
SURFACE AND 6-INCH VERTICAL PROFILE SOIL SAMPLING

Step	Hazard	Controls
Layout of sample plots	<p>Ambient levels of suspect contaminants</p> <p>Slips, trips, and falls (all tasks)</p> <p>Manual material handling (all tasks)</p> <p>Cuts, scrapes and contusions to hands (all tasks)</p>	<p>Prescreening of sample area for radionuclides and nonradioactive contaminants and use of real-time monitoring.</p> <p>Employees will wear footwear appropriate for existing conditions and avoid areas where falls are probable.</p> <p>Employees will follow material handling requirements given in Section 5.5.5.</p> <p>Employees will wear leather gloves when performing work that may result in cuts, scrapes, and contusions.</p>
Removal of over-burden and collection of samples	<p>Ambient levels of suspect contaminants (all tasks)</p> <p>Contact with contaminants</p> <p>Generation of airborne dusts</p>	<p>Personal and real-time monitoring for dusts and organics.</p> <p>Use of mist from spray bottles or orchard sprayers to control dust.</p> <p>Personnel shall wear PPE as specified for each IHSS in Section 8.0.</p>
Containerization of sample	Contact with sample	Personnel shall wear PPE as specified for each IHSS in Section 8.0.
Decontamination of equipment	Splashing of decontamination solutions	<p>Personnel shall wear safety glasses with side shields in addition to PPE specified in Section 8.0.</p> <p>Personnel coming into contact with contaminated wastes shall immediately go through decontamination.</p>

Notes: PPE = Personal Protective Equipment

95-DNR-ERM-0004
Acetic Acid (glacial). Acetic acid vapor attacks the respiratory system, skin, eyes, and teeth and may produce irritation by inhalation, absorption and ingestion. Inhalation of concentrated vapor may cause serious damage to the lining membranes in the nose, throat and lungs. Contact with concentrated acetic acid may cause severe damage to the skin and eyes.

Bronchopneumonia and pulmonary edema may develop following acute over exposure. Chronic exposure may result in pharyngitis and catarrhal bronchitis. Ingestion, though not likely to occur, may result in bloody vomiting, diarrhea, shock and hemolysis which is followed by arrest of urinary output.

Acetone. Acetone is a highly volatile and flammable colorless liquid with a fragrant mint-like odor. Its lower explosive limit (LEL) is 2.9 percent and upper explosive limit (UEL) is 12.8 percent by volume in air. Acetone is widely used as an industrial solvent and chemical intermediate. Inhaling concentrations of 1,000 parts per million (ppm) or less irritates the eyes, nose, and throat. Symptoms of overexposure include dizziness, nausea, lack of coordination, loss of coordinated speech, and drowsiness.

Aluminum. Occupational hazards relate primarily to the inhalation of aluminum particulates, which has been linked to the development of pulmonary fibrosis.

Aluminum Nitrate. Aluminum nitrate is an inorganic compound created by bonding the elemental aluminum with the nitrous trioxide ($-\text{NO}_3$) radical. Toxic effects from ingesting large amounts of aluminum nitrate include dizziness, abdominal cramps, vomiting, convulsions, collapse, and death. Inhalation may result in pulmonary fibrosis. Chronic exposure to small doses may result in weakness, general depression, headache, and mental impairment. Increased rates of cancer in exposed populations have also been observed. Aluminum nitrate appears as white crystals, it is a powerful oxidizer, is incompatible with reducing agents, and is a moderate fire hazard through spontaneous combustion. When heated to decomposition, aluminum nitrate will emit nitrate nitrogen oxide (NO_x) fumes.

Americium. The toxic effects of americium, a transplutonium radionuclide, are similar to plutonium. Please refer to plutonium for a discussion of those effects.

Ammonia. Ammonia's routes of entry are through inhalation, ingestion, skin, and eye contact, with points of attack at the lungs, respiratory system and eyes. Once inhaled, ammonia becomes an irritant to the nose and throat, and may cause long-term respiratory problems at high levels. Signs and symptoms of exposure are irritated eyes, inflammation of the nerve membranes in the eye (conjunctivitis) and swelling of the eyelids. It is also an irritant to the nose and throat, causing coughing, difficult breathing, and vomiting. Ammonia has a sharp pungent odor, and has no chronic effects reported in humans.

Ammonium Hydroxide. Ammonia hydroxide exposure can cause severe irritation to the nose, throat and lungs. Death may be caused by suffocation of fluid build-up in the lungs. Ammonia hydroxide is a corrosive chemical and can burn the skin and eyes causing permanent damage. Long term exposure at low levels may cause chronic bronchitis.

It is observed as a colorless to milky white liquid with 2 strong irritating odor.

Ammonium Thiocyanate. Contact with ammonia thiocyanate may cause irritation to the eyes and skin. Long-term exposure may cause runny nose, abdominal problem, weight loss, weakness, and skin rashes. No criteria or standards has been set regarding permissible exposure limits in the air or water.

Arsenic. Arsenic is a poison by subcutaneous, intramuscular, and intraperitoneal routes. Effects of arsenic exposure include the systemic poisoning of the skin and gastrointestinal tract. Arsenic is a human carcinogen, an experimental teratogen, and mutagenic effects have also been observed. Arsenic is also corrosive to skin and mucous membranes and may cause skin sensitization.

Arsenic appears as a silver to black, brittle, crystalline, metalloid. As a dust, arsenic is flammable when exposed to heat, flames, or incompatible chemicals. Arsenic is incompatible with powerful oxidizers, bromozide, halogens, palladium, zinc, platinum, chromium trioxide, and other chemicals. When heated or in contact with acid or acid fumes, arsenic can emit toxic fumes.

Beryllium. Beryllium is among the most toxic elements investigated and is primarily a hazard through skin contact and inhalation. Skin contact may result in slow-healing ulcerations, often resulting in excision, and splinters and embedded particles of beryllium have also been related to granulomatous lesions. Inhalation of beryllium dusts may lead to the development of berylliosis, a granulomatous lung disease. Additional acute effects of beryllium inhalation include pneumonitis and hypersensitivity. Beryllium is a suspected human carcinogen. Beryllium is a hard, brittle metal with a gray-white color, and it is nonflammable and incompatible with acids, caustics, chlorinated hydrocarbons, oxidizers, and molten lithium.

Cadmium. Inhalation of cadmium can result in pulmonary edema and difficulty in breathing. Ingestion of cadmium may result in abdominal pain, nausea, vomiting, and diarrhea. Cadmium is a carcinogen. Long-term low-level exposure to cadmium may result in emphysema and chronic renal tubular disease.

Cadmium appears as hexagonal crystals or silver white metal. Cadmium dust is flammable and explosive when exposed to heat, flame, or incompatible chemicals. Elements incompatible with cadmium include oxidizing agents, metals, HN_3 , zinc, selenium, and tellurium.

Cadmium Cyanide. Cadmium cyanide toxicity is primarily related to the cadmium component of the compound. Cadmium cyanide is a suspected human carcinogen and may cause poisoning of the lungs, bone, blood, and liver. An irritant to eyes, skin, and mucous membranes, cadmium cyanide may also cause blurred vision, nausea, irritation, coughing, and cyanosis.

Cadmium cyanide appears as white crystals or a powder. It is a noncombustible solid. Contact may result in irritation to the eyes, skin, and upper respiratory tract.

Calcium Fluoride. Calcium Fluoride can enter the system either by inhalation of dusts, or by ingestion. Most reported cases of calcium fluoride toxicity are due to accidental ingestion, mild symptoms are nausea, diarrhea and vomiting. More severe symptoms are burning and painful abdomen, sores in mouth, throat and digestive tract, and shock. In extreme cases, death can occur.

If calcium fluoride is inhaled, difficulty in breathing, burning of mouth, throat and nose will result at low levels. Nausea, vomiting, extreme sweating, and excess thirst occur at higher levels: Calcium Fluoride is colorless crystalline or white, powdery substance.

Calcium Hydroxide. Calcium hydroxide exposure may cause severe irritation to mouth, throat and lungs if the dust is inhaled. If it is ingested, calcium hydroxide will cause irritation, soreness and chemical burns to the throat, mouth and digestive tract. The estimated lethal dose to this substance is about 1 pound. There is no known information regarding long term exposures.

Calcium Oxide (Lime). Calcium oxide is caustic to living tissue, and it appears as a colorless crystal. Calcium oxide contact with water will generate heat.

Carbon Disulfide. Carbon disulfide is toxic by inhalation, a poison by ingestion, and it may also be absorbed through the skin. Carbon disulfide is an experimental teratogen and some data suggest mutagenic effects. The primary effects of carbon disulfide target the central nervous system causing narcotic and anesthetic effects with acute exposures. Chronic exposure to carbon disulfide may result in damage to the peripheral and central nervous system, and has been linked to the development of heart disease. Dermatitis may also result from skin contact with carbon disulfide.

Carbon disulfide is colorless to faint yellow with a sweet ether-like odor. Reagent grades may produce a foul-smelling odor. The LEL is 1.3 percent and the UEL is 50.0 percent, with a flash point of minus 22 degrees Fahrenheit. Carbon disulfide is incompatible with strong oxidizers, chemically active metals, acids, rust, halogens, and amides. Carbon disulfide emits sulfur oxides (SOx) when heated to decomposition and reacts powerfully with oxidizing agents.

Carbon Tetrachloride. Carbon tetrachloride is a poison by ingestion and moderately toxic by inhalation. Skin contact with carbon tetrachloride may result in dermatitis, and eye contact may result in severe irritation. Carbon tetrachloride is an experimental carcinogen and teratogen as well as a suspected human carcinogen. Other effects of exposure to carbon tetrachloride include central nervous system depression, nephrotoxicity, and hepatotoxicity. Concentrations of 1,000 to 1,500 ppm are necessary to cause acute effects. Carbon tetrachloride is a colorless liquid and produces an ether-like odor. Carbon tetrachloride is nonflammable but is reactive with fluorene, metals, and various less common compounds.

Chloroethane (ethylchloride). Routes of entry include inhalation, slight percutaneous absorption, ingestion, eye and skin contact. Exposure may produce headache, dizziness, incoordination, stomach cramps, and eventual loss of consciousness. Target organs include liver, kidneys, respiratory system, and cardiovascular system.

Chloroform. Chloroform has been listed as a suspected human carcinogen by the American Conference of Industrial Hygienists (ACGIH). Its routes of entry vary from the inhalation of vapors to ingestion and skin and eye contact. Upon entry, chloroform affects the liver, kidneys, heart, eyes and skin. There are several symptoms of acute chloroform exposure. these symptoms include dizziness, vomiting, nausea, fatigue and headaches. Other symptom are respiratory depression, coma, kidney and liver damage.

Symptoms of chronic exposure include loss of appetite, hallucinations, moodiness and physical and mental fatigue. Chloroform is classified as moderately toxic. It is a central nervous system depressant, and extreme exposures are attributable to cardiac arrest and death.

Chromium and Chromium Compounds. Chromium and its associated compounds are known to produce a variety of effects depending on the compound. Chromic acid is corrosive to the skin and mucous membranes, and its primary effect is a deep penetrating ulcer, which is slow to heal. Ulcerations most notably occur on the hands, forearms, and nasal septum. Chromate salts are experimental and confirmed human carcinogens of the lungs, nasal cavity, and paranasal sinus, and experimental carcinogens of the stomach and larynx. Eczematous dermatitis from trivalent compounds has also been reported, as have liver and kidney damage. Chromium and its specific properties vary in appearance from compound to compound.

Copper. Copper is poisonous by ingestion. Inhalation of copper may result in red blood cell lysing, hemofuscin deposition within the liver and pancreas, damaged lung cells, and it may also cause an allergic reaction resulting in conjunctiva, skin and respiratory tract irritations, and metal fume fever.

Copper is a reddish colored metal that is incompatible with oxidizers, alkalis, sodium azide, and acetylene.

Cyclohexane. Cyclohexane is an irritant to the eyes, skin, nose and throat. Prolonged or repeated exposure may cause skin rash and dermatitis. Short term exposures by inhalation at low levels cause irritation to eyes, nose and throat. Higher concentration may act as a narcotic resulting in dizziness, vomiting or loss of consciousness. Higher exposures can cause death.

Cyclohexane ingested may cause liver, kidney, brain, heart and circulatory system damage.

Cyclohexane is a colorless liquid with a mild, sweet odor.

Diesel Fuel. Diesel fuel is a skin and mucous membrane irritant and a central nervous system depressant. Dermal contact with diesel fuel may cause blistering and open sores. Tumorigenic effects have been observed.

Diesel fuel is a brown oily liquid with a petroleum odor. The LEL and UEL are 1.3 percent and 6 percent, respectively. Diesel fuel is incompatible with strong oxidizers and heat.

Ethylene Glycol. Ethylene glycol is an irritant when inhaled. Ingestion is another route of exposure and its symptoms differ according to the amount ingested. Small amounts may cause nausea, vomiting, dizziness and loss of coordination. Large amounts of ethylene glycol may cause coma, convulsions and death.

Ethylene glycol is a colorless, odorless, viscous liquid with a sweetish taste.

Fluoride. Fluoride is an irritant to the eyes, skin, and mucous membranes. Fluoride contact with skin may result in dermatitis. Acute exposures to fluorides result from exposures to hydrofluoric acid. Refer to hydrofluoric acid for a discussion of those effects. Chronic overexposure to fluoride may result in sclerosis of the bones, calcification of ligaments, and dental mottling. Large doses of fluoride may result in severe nausea, vomiting, diarrhea, abdominal burning, and cramp-like pains. Symptoms of fluoride intoxication include gastric, intestinal, circulatory, respiratory, and nervous complaints and skin rashes.

Fluoride may appear as an odorless white powder, colorless crystals, or a colorless to dark solid. The exact appearance depends on chemical composition. Fluoride is incompatible with strong oxidizers and is nonflammable. When heated to decomposition fluoride will emit toxic fumes.

Graphite. Graphite in the form of a dust may cause the development of a pneumoconiosis or anthracosilicosis by inhalation. Graphite-containing silica has produced fibrogenic changes in

animals. Inhalation of graphic dust can result in coughing, dyspnea, black sputum and pulmonary function impairment.

Graphite is steel gray to black in color, is greasy, and is an odorless solid, and is incompatible with strong oxidizers.

Hydrochloric Acid. Hydrochloric acid is irritating and corrosive to the eyes, skin, and mucous membranes by contact, inhalation, and ingestion. Severe respiratory exposure may result in pulmonary edema and laryngeal spasms. Some data suggest exposure to hydrochloric acid may produce mutagenic effects.

Hydrochloric acid is colorless to slightly yellow with a pungent odor, nonflammable, and incompatible with metals, hydroxides, amides, and alkalis. Hydrochloric acid is also corrosive to most metals and will react with water and steam to produce toxic and corrosive vapors.

Hydrofluoric Acid. Hydrofluoric acid is very corrosive and irritating to the eyes, skin, and mucous membranes at concentrations of 0.05 milligrams per liter (mg/l). Vapor inhalation may cause ulceration of the upper respiratory tract. Skin burns from hydrofluoric acid are slow healing with subcutaneous tissues becoming blanched and bloodless and affected by gangrene.

Hydrofluoric acid is a colorless gas or fuming liquid (below 67 degrees Fahrenheit) with a strong irritating odor and is nonflammable. Metals, water, and steam are incompatible with hydrofluoric acid, and it will attack glass and concrete. When heated, hydrofluoric acid will emit corrosive fluoride fumes.

Hydrogen Peroxide. Hydrogen peroxide is irritating to the eyes, skin, and mucous membranes. The degree of effect is dependent on the concentration. Severe poisoning may result in headaches, dizziness, tremors, and pulmonary edema. Some data suggest hydrogen peroxide may produce mutagenic effects.

Hydrogen peroxide is a colorless heavy liquid with a sharp odor, and below 12 degrees Fahrenheit may appear as a crystalline solid. Hydrogen peroxide is nonflammable and incompatible with oxidizable materials, iron, copper, brass, bronze, chromium, zinc, lead, manganese, and silver. Contact with combustible material may result in spontaneous combustion. Hydrogen peroxide is an extremely powerful oxidizer. In extremely pure or concentrated forms, hydrogen peroxide may detonate when subjected to heat, mechanical impact, or combined with metals or other organic compounds.

Iodine. Iodine is irritating to the eyes, skin, and mucous membranes. Iodine is seldom an exposure problem because of its low volatility, but can be irritating to the lungs when inhaled. Severe exposure via inhalation may result in pulmonary edema. Iodine may cause burning of the eyes, lachrymation, coughing, and irritation of the nose and throat.

Iodine appears as violet-black crystals, can react with reducing materials, and it is noncombustible.

Iron. Iron is an intraperitoneal poison. Contact with iron dust may result in conjunctivitis, choroiditis, retinitis, and siderosis of tissues. Fresh iron oxide fumes can cause metal fume fevers benign pneumoconiosis, chronic bronchitis, and siderosis.

Iron is silvery white in appearance. Incompatibilities of iron include calcium hypochlorite, chlorine, chlorine fluoride, fluorine, hydrogen peroxide, nitrous oxide, phosphorus, sodium dichloride, sulfuric acid air, water, and polystyrene. Iron dust is a moderate explosion hazard when exposed to heat or flame.

Lead. Lead is an experimental lung and kidney carcinogen. In experimentation it has been shown to be teratogenic. Lead is a moderate irritant and a poison affecting the central nervous system. Symptoms of overexposure include weakness, tremors, headache, or nausea and vomiting.

Lead is a soft, blue-gray metal. As a dust, lead is flammable and incompatible with ammonium nitrate, chlorine trifluoride, hydrogen peroxide, zirconium, disodium-acetaldehyde, and oxidants. Lead is highly reactive with oxidants.

Lithium. Lithium compounds may form caustic solutions in water and corrode living tissue. The lithium ion has shown toxic effects on the central nervous system. Lithium compounds have been implicated in the development of aplastic anemia. Large doses of lithium compounds have been shown to cause kidney damage, anorexia, apathy, and nausea. Chronic lithium exposure has resulted in tubular defects and interstitial nephritis in the kidneys.

Lithium Chromate. Lithium chromate is an irritant to the eyes, skin, and mucous membrane, as well as the respiratory tract. Lithium chromate can also cause skin sensitization, and it is a known human carcinogen. Symptoms of overexposure include irritation, dizziness, eczema, skin ulceration, and conjunctivitis. More pronounced effects include vomiting, shock, and nausea.

Lithium chromate is a yellow, crystalline solid. Upon melting, lithium chromate decomposes. Lithium chromate is noncombustible.

Magnesium. Inhalation of magnesium dust and fumes can cause metal fume fever, and particles imbedded in skin can result in gaseous blebs and gangrene. Magnesium can also cause irritation of the eyes and nose, conjunctiva, and discolored sputum.

Magnesium is a silver-white crystal and is a combustible solid. It is incompatible with air, moisture, acids, halocarbons, halogens, carbon tetrachloride and a broad range of other less common chemicals. Magnesium powders may be ignited with small sparks or flames. Once ignited, magnesium powders may be approached to within a few feet if no moisture is present.

Mercury. Mercury can enter the body through inhalation, skin, absorption and eye and skin contact. Inhalation of mercury is the route of most concern. At small doses, non specific

95-DME-ERM-0004 symptoms such as shyness, loss of appetite and insomnia occur. Large doses may result in flu-like symptoms (headache, nausea, vomiting, diarrhea). In severe doses, death may occur due to pneumonia.

Mercury is released from the body slowly, causing accumulation. In long term exposures, mercury accumulates in the brain, liver and kidneys. It may cause headaches, dizziness, defective muscle control, loss of teeth, impaired memory and possible brain damage.

Mineral Spirits. Mineral spirits (petroleum spirits or distillates) is moderately toxic by inhalation resulting in intoxication, headache, nausea, and, in high concentrations, coma and hemorrhaging of internal organs. Ingestion may result in burning sensations, vomiting, drowsiness, and pulmonary edema. Mineral spirits is also a systemic and mucous membrane irritant.

95-DME-ERM-0004 Mineral spirits is a clear and colorless liquid. It is flammable and has a UEL of 5.9 percent and an LEL of 1.1 percent. Mineral spirits is incompatible with strong oxidizers.

95-DME-ERM-0004 Nickel. Nickel is a listed carcinogen, and is most dangerous when inhaled. Skin contact may cause itching and redness. High exposures to nickel leads to asthma type symptoms. These include shortness of breath, fluid build up in the lungs and severe coughing. Nickel in large doses can cause death.

Nickel Sulfate. Nickel sulfate is a confirmed carcinogen and mutagen. Nickel compounds may produce skin sensitization and dermatitis.

Nickel sulfate appears as cubic yellow crystals. When heated to decomposition, nickel sulfate emits toxic fumes of SOx.

Nitrated Wastes. Nitrates, as a class, are toxic by ingestion resulting in dizziness, abdominal cramps, vomiting, bloody diarrhea, convulsions, and collapse. Chronic low dosages may lead to weakness, general depression, headache, and mental impairment.

Nitrates may be formed by the bonding of the -NO_2 radical with an organic molecule or a monovalent -NO_3 radical with an inorganic molecule. Appearance varies from compound to compound. All nitrates are powerful oxidizing agents that may explode when subjected to shock, heat, flame, or spontaneous chemical reaction. When heated to decomposition nitrates emit toxic fumes including NO_x . Nitrates are incompatible with reducing agents. Exposure levels vary and are compound specific.

Nitric Acid. Nitric acid is poison by ingestion and corrosive to eyes, skin, mucous membranes, and teeth. Inhalation of nitric acid may cause respiratory irritation that may subside briefly and return hours later more severely. Inhalation of nitric acid may also cause pulmonary edema and chronic obstructive lung disease.

Nitric acid is flammable on contact with reducing agents and is an oxidizer. Nitric acid has a broad range of incompatibilities and will react with water and steam to liberate large quantities of heat and corrosive vapors. Nitric acid will emit NO_x and hydrogen nitrate when heated to decomposition.

Phosphoric Acid. Phosphoric acid is toxic by ingestion and skin contact. Contact may result in eye and skin irritation that may include skin burns, corrosion, and dermatitis. Inhalation of phosphoric acid may result in irritation of the respiratory tract.

Phosphoric acid is a colorless, odorless crystalline solid. Phosphoric acid is not flammable, but will react with metals to form hydrogen gas, and is incompatible with strong caustics and most metals. Phosphoric acid may also appear as a colorless, noncombustible liquid when in aqueous form.

Plutonium. Plutonium is an extremely powerful radiotoxin. Primary toxic effects are associated with elemental plutonium, and secondary toxic effects are from any other atoms or functional groups contained in a plutonium compound. Inhalation hazards stem from uptake of alpha-emitting radioactive particulates. Once inhaled, the particulates can initiate ionization of pulmonary tissues and be absorbed into the body. Experimental data have shown plutonium to cause radiation pneumonia, moderate to severe pulmonary fibrosis, and bronchioloalveolar cancer. Absorption of plutonium results in deposition of the nuclide on skeletal surfaces and within the liver. Once deposited on the skeletal surfaces, radiotoxic effects may be magnified by equivalent activities.

Polychlorinated Biphenyls. Polychlorinated biphenyls (PCBs) are highly persistent and bioaccumulative as pollutants. PCB acute toxicity is low, but chronic toxicities are very similar to chlorinated pesticides. PCBs are liver toxins with long-term exposure and, at high doses, have caused suppression of the immune system, reproductive dysfunction, birth defects, and liver tumors. PCBs are considered skin absorbers and are known to produce the dermatitis condition of chloracne. PCBs are carcinogens identified by NIOSH. PCB compounds have low solubilities in water and low vapor pressures, but are soluble in most of the common organic solvents, oils, and fats. The compounds are stable to acids and alkali, resistant to oxidation, and are subject to photodechlorination when exposed to sunlight.

Portland Cement. Portland cement is primarily a nuisance dust, and can be irritating when inhaled. Related hazards, including silicosis or asbestosis, are possible if silica or asbestos are used as major components of the cement mixture.

Potassium Hydroxide. Potassium hydroxide is a severe skin irritant and is corrosive to the eyes, skin, mucous membranes, and the respiratory tract. Ingestion of potassium hydroxide may cause severe pain in the throat and epigastrium resulting in hematemesis, collapse, and stricture of the esophagus.

Potassium hydroxide exhibits violent exothermic reactions with water and is nonflammable. Potassium hydroxide is incompatible with water acids, flammable liquids, organic halogens, and various metals.

Potassium Hydroxide. Potassium hydroxide is dangerous when breathed in. It is a highly corrosive substance. Eye contact with potassium hydroxide causes server burns immediately, and can lead to blindness. Exposure can initiate the nose, throat, and airways causing sneezing, coughing and scars in the nose. Higher levels can initiate the lungs and cause fluid buildup. This can eventually cause death.

Silver. Silver may cause skin effects at concentrations of 1 milligram per cubic meter (mg/m³). Deposition of silver in human tissues may cause the appearance of a grayish pigmentation in the conjunctiva, mucous membranes, and skin after two to 25 years of exposure. Silver is also a skin and mucous membrane irritant as well as an experimental tumorigen. Lesions on the kidney and lungs have also been attributed to industrial exposures.

Silver is a flammable dust when exposed to flames and by chemical reaction with ethane, ammonia, bromoazide, chlorine trifluoride, ethylene amine, hydrogen peroxide, oxalic acid, sulfuric acid, and tartaric acid.

Sodium. Sodium is moisture reactive and corrosive to living tissue. Sodium can react with moisture to yield sodium hydroxide and can cause thermal and chemical burns.

Sodium is a light silver-white ductile material. It is incompatible with air, moisture, and a wide variety of chemicals.

Sodium Bicarbonate. Sodium bicarbonate is used as a food ingredient and has few toxic effects. It is an odorless white powder granule.

Sodium Fluoride. Sodium fluoride is a poison by ingestion to humans, an eye irritant, and causes central nervous system effects. Sodium fluoride is an experimental teratogen. Signs and symptoms of overexposure include nausea and vomiting, abdominal distress, diarrhea, stupor, and weakness. More pronounced exposures at high levels may result in muscular weakness, tremors, convulsions, collapse, dyspnea, and respiratory and cardiac arrest. Chronic exposures may result in dental mottling, vomiting, diarrhea, and central nervous system effects. Sodium fluoride is also phytotoxic.

Sodium fluoride may appear as clear crystals or a white powder or balls. When heated to decomposition sodium fluoride emits water vapor (H_2O) and fluorine gas.

Sodium Hydroxide. Sodium hydroxide is corrosive to human tissue, causing burns, deep ulceration, and scarring; and is an eye, skin, and mucous membrane irritant. Inhalation of sodium hydroxide may result in mild irritation of the mucous membranes to severe pneumonitis depending on the concentration. Sodium hydroxide is highly soluble, irritation is noticeable immediately, and skin contact may also cause dermatitis.

Sodium hydroxide is colorless and odorless is considered nonflammable, and may generate sufficient heat to ignite combustible materials when contacted with water.

Sulfuric Acid. Sulfuric acid is an eye irritant, a corrosive, and is toxic to human tissue. Skin contact with sulfuric acid will result in tissue destruction and severe burns. Chronic exposure to dilute solutions may result in dermatitis and inflammation of the upper respiratory tract leading to chronic bronchitis by inhalation. Inhalation of concentrated vapors or mist may cause chemical pneumonitis.

Sulfuric acid is a colorless, odorless, oily liquid. Sulfuric acid is miscible with water, liberating large amounts of heat. Toxic vapors are emitted when sulfuric acid is heated. Sulfuric acid is a powerful oxidizer, can react with reducing materials, and can emit SO_x .

Tetrachloroethylene. Tetrachloroethylene is moderately toxic by inhalation and is irritating to the skin and eyes; and is also an experimental carcinogen. Prolonged contact with skin can result in dermatitis, chemical burns and blistering, while ingestion can result in gastrointestinal tract irritation. Inhalation can result in central nervous system depression.

Tetrachloroethylene is a colorless liquid with a mild chloroform-like odor. Synonyms include perchloroethylene, perchloroethene, and tetrachloroethane.

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Toluene. Toluene is known to produce a variety of effects depending as the amount inhaled, ingested, absorbed, or in contact with. If inhaled, toluene can cause dizziness, drowsiness and hallucinations. In larger amounts, toluene has been known to cause headaches, loss of energy, and coma. Ingestion symptoms are similar to inhalation. They differ only by a burning sensation in the mouth, stomach and upper abdominal pain. Irritation may occur as a result of eye and skin contact. Toluene is a clean, colorless liquid with a sweet pungent odor.

Trichloroethane. Trichloroethane (TCE) is widely used as an industrial solvent, particularly in metal degreasing and extracting processes. TCE is sometimes used as a chemical intermediate and also as an anesthetic. TCE does not have flash point as determined by standard tests in air and is considered to be a low fire hazard. TCE is a colorless liquid with a boiling point of 87 degrees Celsius. TCE has low water solubility at 0.1 gram (g) per 100 ml, has a high vapor pressure, and can reach concentrations of 10.2 percent in "saturated" air.

The predominant physiologic response to TCE exposure is central nervous system depression. The depression is particularly evident with acute exposure. Visual disturbances, mental fatigue, and sometimes nausea and vomiting have also been observed. Sensitization of the heart to adrenaline has been reported, but apparently is not a significant problem unless anesthetic levels are attained. Degreaser's flush, in which the skin of the face and arms become extremely red, can occur if alcohol is consumed shortly before or after exposure to TCE. TCE has produced

hepatocellular carcinomas in mice but not rats; hence, the significance of carcinogenesis as a result of TCE is unclear at this time.

1.1.1-Trichloroethane. 1,1,1-Trichloroethane (TCA) is a moderate skin and severe eye irritant. Inhalation may result in central nervous system depression at levels as low as 500 ppm. TCA has also caused kidney and liver damage and cardiac sensitization. TCA has an objectionable odor at 500 ppm.

TCA is a colorless liquid that is nonflammable. TCA reacts violently with nitrogen peroxide, oxygen, liquid oxygen, sodium, sodium hydroxide, and sodium-potassium alloys. A synonym for TCA includes methylchloroform.

Tritium. Tritium is a beta-emitting isotope of hydrogen that readily exchanges with other hydrogen atoms in water and water soluble human tissue. Once inhaled or ingested, tritium is readily distributed into human tissue and causes ionization as a result of beta decay. Tritium has a short biological half-life and is readily excreted from the body. In the environment, tritium is subject to considerable transport because of its solubility. Elemental tritium is a gas, unidentifiable by odor.

Uranium. Uranium is toxic in acute doses. Toxic effects from the intake of soluble uranium include kidney damage and necrotic arterial lesions. Inhalation of insoluble particulates results in radiotoxic effects to the lungs and bone. NIOSH has identified uranium as a potential carcinogen.

Uranium is a silver white, malleable, ductile metal. Uranium is a combustible solid, incompatible with chlorine, fluorine, nitric acid (HNO_3), NO_x , selenium, water, sulfur, ammonia, bromine trifluoride (BrF_3), trichloroethylene, and nitryl fluoride. Uranium may form a pyrophoric surface during storage because of reactions with air and moisture. Please refer to

nitrated wastes in this section for a discussion of additional properties of uranium nitrate as an inorganic nitro compound.

95-DMR-ERM-0004 Xylenes. Xylene is used as a solvent, and is a constituent of paint, lacquers, cements, cleaning fluids and aviation fuels. Xylene exist in three isomeric forms, ortho-meta-and para. Xylenes many enter the system through inhalation vapor, ingestion absorption and lain and eye contact, although the most probable routes are inhalation and skin contact. Inhalation of vapor can cause irritation to the nose and throat. At higher concentrations, xylene intoxication may occur. Symptoms include headache, dizziness and nausea. if exposure should continue, central nervous system depression can occur. At sudden high concentrations of vapor, irreversible liver and kidney damage may occur. Such high levels may also cause lung congestion. Contact with vapor or liquid can also cause skin and eye irritation.

5.2.3 Unspecified Chemicals

Chemicals of concern for work to be conducted include mixtures of process-specific solutions, trade name chemicals, and those implied through descriptions of the events leading to the potential contamination of individual sites. They are given below:

- hydraulic oil
- process waste water
- cooling tower blowdown
- effluent spill
- heavy metals
- machining oil/cutting oil
- unspecified hydrocarbons
- unspecified solvents
- unspecified acids
- unspecified soaps
- nitrad
- unspecified oils
- unspecified radioactive contaminants
- nitrate
- unspecified bases
- compressor oil
- waste liquids
- waste paint and paint solvents
- coolants
- unspecified chlorinated solvents
- unspecified volatile organic compounds (VOCs)
- developer

- fixer
- grease
- fiberglass resins
- fiberglass catalysts
- pondcrete
- freon-based lathe coolant
- polyester resin peroxide catalysts
- unspecified wastes
- product water
- oil-based coolant

The above listed chemicals are continuing to be researched. At present there is insufficient information to complete a thorough hazard assessment. As new contaminants are identified, they will be added to this HSP through revisions.

5.3 RADIATION HAZARDS

At many of the Integrated OU project sites there is potential for concentrations of uranium, uranium oxide, depleted uranium, enriched uranium, americium, americium chloride, americium sulfate, plutonium, plutonium oxide, plutonium nitrate, and tritium. These radionuclides may be found in surface and subsurface soil, dust, surface water, groundwater, and mechanical equipment or stationary structures. The concentrations of these elements are unknown for all of the sites where work is to be done under this plan. Prework area monitoring will be accomplished before work begins and subsequent monitoring during sampling activities will be conducted to characterize radiological conditions in accordance with EG&G RFP Environmental Management Division (EMD) Manual Operations SOP Field Radiological Measurements, No. FO.16, Revision 2.

5.4 PROJECT TASK ANALYSIS

To generate the analysis for each work task, the following assumptions were used to qualify the magnitude of the chemical and radiological hazards:

- The work to be conducted under this HSP is in open areas with no impediments to natural ventilation. Exceptions to this assumption include those activities associated with soil sampling from beneath concrete or asphalt.
- All engineering, PPE, and procedural requirements will be followed and enforced to limit contaminant exposure to ALARA.
- Inhalation and dermal contact with contaminated particulates resuspended in the atmosphere, either by work conducted under this plan or natural forces, will be the primary routes of exposure for chemical contaminants and alpha radiation. Airborne alpha radioactivity will be sampled during work activities. If sampling results are equal to or greater than 10 percent of the action level defined in DOE 5480.11, actions to be taken will be determined with EG&G Radiological Engineering (Section 6.4).
- Alpha, beta, and gamma radiation levels will be noted during prework surveys. If levels of each type of radiation are within acceptable limits as defined in DOE 5480.11, work will proceed unimpeded. Actions to be taken when unacceptable radiation levels are noted will be determined in conjunction with EG&G Radiological Engineering.

Following is a discussion of hazards associated with sampling tasks to be performed under this plan. Each discussion is presented in the form of a job safety analysis (JSA). The tasks have been separated into discrete steps and for each step identified, hazards and corresponding hazard control methods are listed. Hazards associated with individual IHSSs and activities, as well as other health and safety issues, will be reviewed in daily tailgate safety meetings.

Radiation surveys, tank and pipeline inspections, and geophysical surveys will be low hazard tasks. Primary hazards will include slips, trips, and falls; manual material handling; and exposures to ambient concentrations of contaminants in the air. When usual hazards are not expected, JSAs have not been generated. These hazards will be controlled by using appropriate footwear, maintaining awareness of surrounding conditions and hazards, following good manual

material handling practices, and using real-time and personal sampling as described in Section 6.0.

5.4.1 Surficial Soil and 6-Inch Vertical Profile Sampling

Surficial soil sampling will be conducted at the IHSSs listed in Table 3-1. Soil samples will be obtained from the surface of the ground to a maximum depth of 6 inches. Some soil sample sites may require the removal and patching of asphalt and concrete. Given below are the steps required to perform the work, associated potential hazards, and hazard control measures. Concrete and asphalt removal is addressed in Section 5.4.2. Table 5-4 summarizes the hazards and controls for these activities.

5.4.2. Asphalt and Concrete and Removal Sampling

Asphalt and concrete will be removed to collect surficial soil samples in areas covered by asphalt and concrete as well as to sample the asphalt and concrete itself. The size of the pieces to be removed may vary from a 4- to 6-inch diameter coring to a 30- by 30-inch area that may be sawed. Table 5-5 summarizes the hazards and controls for these activities.

5.4.3 Polychlorinated Biphenyl Sampling

PCB sampling will be conducted in areas where PCBs are a suspected contaminant. Samples will be collected either by using a swipe moistened with solvent wiped within a 100-square-centimeter (cm²) template, or by obtaining a sample of the potentially contaminated media by chopping, sawing, or drilling. Table 5-6 summarizes the hazards and controls for these activities.

TABLE 5.4
ASPHALT AND CONCRETE REMOVAL AND SAMPLING

Step	Hazard	Controls
Set up of asphalt and concrete saw or coring machine	<p>Ambient levels of radioactive and nonradioactive contamination (all tasks)</p> <p>Manual material handling (all tasks)</p> <p>Cuts, scrapes, and contusions (all tasks)</p>	<p>Prescreening for contaminants (radioactive and nonradioactive)</p> <p>Personnel shall follow material handling requirements given in Section 5.5.5.</p> <p>Personnel shall wear leather work gloves while performing work.</p>
Cutting/coring of asphalt or concrete	<p>Generation of airborne dusts</p> <p>Contact with moving parts</p> <p>Overexposure to contaminants (all tasks)</p> <p>Cuts, scrapes, and contusions (all tasks)</p>	<p>Personnel shall utilize personal protective equipment as outlined in Section 8.</p> <p>Misting shall be used to control dusts.</p> <p>All moving parts shall be guarded as recommended by the equipment manufacturer.</p> <p>Real time and personal sampling shall be used as outlined in Appendix A.</p> <p>Personnel shall wear leather work gloves while performing work.</p>
Removal of asphalt or concrete	<p>Manual material handling</p> <p>Overexposure to contaminants</p>	<p>Personnel shall follow the material handling requirements given in Section 5.5.5.</p> <p>Real time and personal sampling shall be used as outlined in Appendix A.</p>
Patching of hole	<p>Contact with patching material</p> <p>Impact with flying chips or particles</p> <p>Overexposure to contaminants</p>	<p>Follow precautions given in material safety data sheets for patching product.</p> <p>Employees shall wear face shield and leather gloves in addition to PPE specified in Section 8.</p> <p>Real time and personal sampling shall be used as outlined in Appendix A.</p>

TABLE 5.5
PCB SAMPLING

Step	Hazard	Controls
Layout and sampling plots	<p>Ambient levels of suspect contaminants (all tasks)</p> <p>Slips, trips, and falls (all tasks)</p> <p>Cuts, scrapes and contusions to hands (all tasks)</p> <p>Manual material Handling (all tasks)</p>	<p>Prescreening of sample area for radioactive and nonradioactive contaminants and monitoring prescribed in Appendix A.</p> <p>Employees will wear footwear appropriate for existing conditions and avoid areas where falls are probable.</p> <p>Employees will wear leather work gloves where necessary.</p> <p>Employees shall follow the general guidelines contained in Section 5.5.5.</p>
Sample collection Non destructive method	Contact with PCB and other contaminants	<p>Personnel shall utilize the PPE required by Section 8.</p> <p>Sample will be taken utilizing a wet swipe.</p>
Sample collection Destructive method	<p>Contact with PCBs</p> <p>Contact with flying debris</p> <p>Generation of particulate</p>	<p>Personnel shall utilize PPE as required in Section 8.</p> <p>Personnel shall utilize face shields and leather work gloves over PPE.</p> <p>Spray bottles or orchard misters shall be utilized to control dust.</p> <p>Real time air monitoring shall be utilized in order to determine if a rise in ambient dust is occurring.</p>
Containerization sample	Contact with suspected contaminants	Personnel shall utilize PPE as required by Section 8.
Decontamination of equipment	Contact with contaminated solutions	Personnel shall wear splash protection including a face shield.

TABLE 5-6
POLYCHLORINATED BIPHENYL SAMPLING

Step	Hazard	Controls
Layout and sampling plots	<p>Ambient levels of suspect contaminants (all tasks)</p> <p>Slips, trips, and falls (all tasks)</p> <p>Cuts, scrapes and contusions to hands (all tasks)</p> <p>Manual material handling (all tasks)</p>	<p>Prescreening of sample area for radioactive and nonradioactive contaminants and monitoring prescribed in Appendix A.</p> <p>Employees will wear footwear appropriate for existing conditions and avoid areas where falls are probable.</p> <p>Employees will wear leather work gloves where necessary.</p> <p>Employees shall follow the general guidelines contained in Section 5.5.5.</p>
Sample collection Nondestructive method	Contact with PCBs and other contaminants	<p>Personnel shall use the PPE required by Section 8.0.</p> <p>Sample will be taken using a wet swipe.</p>
Sample collection Destructive method	<p>Contact with PCBs</p> <p>Contact with flying debris</p> <p>Generation of particulates</p>	<p>Personnel shall use PPE as required in Section 8.0.</p> <p>Personnel shall use face shields and leather work gloves over PPE.</p> <p>Spray bottles or orchard sprayers shall be used to control dust.</p> <p>Real-time air monitoring shall be used to determine if a rise in ambient dust is occurring.</p>
Containerization sample	Contact with suspected contaminants	Personnel shall use PPE as required by Section 8.0.
Decontamination of equipment	Contact with contaminated solutions	Personnel shall wear splash protection including a face shield.

Notes: PCBs = Polychlorinated Biphenyls
PPE = Personal Protective Equipment

5.4.4 Soil-Gas Survey

Soil-gas surveys will be completed to initially characterize potentially contaminated sites without taking actual soil samples. A hydraulically driven probe will be inserted into the ground and several volumes of air removed. Subsequent analysis of the air will be used to determine contaminants. Table 5-7 summarizes the hazards and controls for this activity.

5.4.5 Surface Water and Sediment Sampling

Surface water and sediment sampling will be conducted to determine the potential surface contamination of various IHSSs. Table 5-8 summarizes the hazards and controls for this activity.

5.5 PHYSICAL HAZARDS

Potential physical hazards associated with field activities at the site include slips, trips, and falls; exposure to splashes and spills; noise; equipment; electrical; utilities; lifting; heat and cold stress; and adverse weather. Personnel must be aware that the protective equipment worn may limit dexterity and visibility and may increase the difficulty of performing some tasks.

5.5.1 Heavy Equipment

Heavy equipment, such as a drill rig or other piece of equipment, used onsite is under the direct control of the subcontractor performing the work. The subcontractor will provide a copy of that company's Health and Safety Program Plan, as stated in the subcontract. The subcontractor is responsible for maintaining the equipment in good working order and operating it safely. All heavy equipment will have audible backup alarms in working condition, moving parts will be guarded, and hydraulics and rigging will be in good condition. Jacobs' personnel will not work near equipment judged to be unsafe because of deterioration, missing parts, obvious defects, or

TABLE 5-7
SOIL-GAS SURVEY

Step	Hazard	Controls
(1) Layout of survey grids and stations	Slips, trips, and falls Contact with contaminants	Personnel will follow procedures in Section 5.5.6. Heat/cold stress procedures in Section 5.5.9. Radiological monitoring per Section 6.4.
(2) Soil-gas sample collection	Exposure to contaminated air. Mechanical and hydraulic hazards. Noise exposure. Heat/Cold stress Underground Utilities Manual material handling Additional hazards contained in Step 1.	Monitoring per Section 6.0. Heavy equipment procedures contained in Section 5.5.1. Noise monitoring and hearing protection per Section 5.5.4. Personnel monitoring per Section 5.5.9. Utility clearance will be performed per Section 5.5.3. Lifting practices per Section 5.5.5. Controls contained in Step 1.
(3) Equipment decontamination	Contact with potentially contaminated rinse water	Personnel will use PPE as required by Section 8.0 and Appendix A.

TABLE 5-8
SURFACE WATER AND SEDIMENT SAMPLING

Step	Hazard	Controls
(1) Layout of survey grids and stations	Slips, trips, and falls	Personnel will follow procedures contained in 5.5.6.
	Contact with contaminants	Radiological Monitoring per Section 6.4.
(2) Sample Collection	Exposure to contaminated air	Monitoring per Section 6.
	Mechanical and hydraulic hazards.	Heavy equipment procedures contained in Section 5.5.1.
	Noise exposure	Noise monitoring and hearing protection per Section 5.5.4.
	Heat/cold stress	Personnel monitoring per Section 5.5.9.
	Underground utilities	Utility clearance will be performed per Section 5.5.3.
	Manual material handling	Lifting practices per Section 5.5.5.
	Additional hazards contained in Step 1	Controls contained in Step 1.
(3) Surface-water sampling	Contact with potentially contaminated surface water	Personnel will use PPE as required by Appendix A.
(4) Sediment sampling	Contact with potentially contaminated sediment	Personnel will use PPE as required by Appendix A.
(5) Equipment decontamination	Contact with potentially contaminated rinse water	Personnel will use PPE as required by Section 7.0.

improper operation. Jacobs personnel will report any unsafe condition to the HSS/HSO or the Site Manager. The HSS/HSO is responsible for ensuring that the subcontractor promptly corrects reported problems.

The subcontractor will be responsible for making provisions to ensure the safety of the equipment operator and other personnel operating equipment in the areas having steep embankments or unstable ground. Operation of heavy equipment in such areas will be avoided whenever possible.

Drilling activities involve a number of hazards including, but not limited to, the following: injuries from flying debris, being caught in machinery, hydraulic failures, unguarded points of operation, airborne particulates, equipment rollover, and other hazards associated with the transportation and use of drill rigs. Jacobs' SOPs for drilling equipment are included in Appendix C.

5.5.2 Electrical

Aboveground utility lines may present a hazard to team members during field activities. A safe distance (20 feet minimum) from overhead utility lines must be maintained at all times. Below-ground utility lines should not pose a hazard as long as the excavation or drilling permit is obtained through the correct process. All hard-line electrical outlets will require a ground fault circuit interrupter.

5.5.3 Utilities

Utility lines, gas pipelines, both aboveground and below ground, may pose a safety hazard to team members. A safe clearance (at least 20 feet) must be maintained between equipment and overhead utility lines. Workers must not rest on any pipelines or place any equipment on the pipelines at any time. The location of utility lines must be determined before hand-augering.

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No hand augering or soil-gas survey is to take place without identifying underground utility lines in conjunction with EG&G RFP personnel and appropriate representative(s) of the utility company(ies). All lines will be considered live unless proven otherwise. Utility clearance will be completed by the client before work begins at each hand-augering site or soil-gas sampling location. Jacobs' SOP for utility clearance (SOP 7.7a), will be used as directed by the HHS/HSO. A copy of Jacobs' SOP 7.7a is provided in Appendix C.

5.5.4 Noise

The main sources of noise for this project are concrete saws/corers, heavy equipment, vehicles, and electric generators. The PEL for noise is 85 decibels on the A-weighted scale (dBA). Sound level monitoring equipment will be used during operations to determine actual noise levels. Hearing protection will be used when noise levels are greater than 85 dBA. Employees will participate in the Jacobs Hearing Conservation program defined in SOP 7.3, Hearing Protection Conservation Policy.

5.5.5 Lifting

Physical injuries are the most likely threat to health and safety. Back injuries from improper lifting constitute the highest probability of injuries. Use the following guidelines when lifting or carrying items:

- Make certain there are no nails or other items protruding that may cause injury during lifting and carrying.
- When lifting, crouch as close to the object as practical, get a good grip on it, keep feet apart, and bend at the knees. Lift slowly by straightening legs. Keep back relatively straight; use leg muscles, not back muscles.

5.5.6 Terrain

The terrain at RFP is open with rolling hills, streams, and ponds. Caution should be taken while working because slips, trips, and falls can become a hazard in this type of terrain.

5.5.6.1 Walking and Working in Open Terrain

Field personnel will become familiar with the general terrain of the site and potential physical hazards (storm water management ponds, uneven terrain) that would be associated with accidental slips, trips, or falls. In addition, personnel should remember the following:

- The period following medium and heavy rainfall could make the ground particularly susceptible to earth movement and slides.
- Workers should be particularly attentive to the area immediately in front of them. It is possible that wells, pits, holes or similar hazards may be partially covered or visually obstructed.
- Workers should be cautious around soil or terrain that may have been recently disturbed, relocated, or otherwise made less stable.
- Workers will avoid the top edges of all drop-off areas.
- Workers will travel in the open terrain in the company of another person.

5.5.6.2 Slips, Trips, and Falls

Field personnel will become familiar with the general terrain and potential physical hazards (ravines, pot holes, and loose gravel) that would be associated with risk of accidental slips, trips, or falls.

5.5.7 Splashes and Spills

Field personnel will wear appropriate chemical-resistant gloves and goggles to prevent potential dermal exposure to accidental splashes and spills that may occur during surface water sampling and decontamination activities.

5.5.8 Precariously Positioned Objects

Field personnel will become familiar with the general area and the potential physical hazards that would be associated with debris or objects that may be piled or scattered around the sites. If objects are stacked in an unsafe manner, the HSS/HSO will notify the EG&G site contact. Field activities will not begin until facility personnel remove or restack the objects in a safe manner.

5.5.9 Heat and Cold Stress

Season-dependent heat and cold stress are anticipated hazards for the work performed at RFP.

5.5.9.1 Heat Stress

Site employees must learn to recognize and treat various forms of heat stress through preventive heat stress management especially when higher levels of PPE are required. In temperatures above 75 degrees Fahrenheit, the following rules should be used:

- Have workers drink 16 ounces of water before beginning work, such as in the morning or after lunch. Provide disposable, 4-ounce cups and water that is maintained at 50 to 60 degrees Fahrenheit. Urge workers to drink one to two cups of water every 20 minutes, for a total of 1 to 2 gallons per day. Provide a cool, preferably air-conditioned area for rest breaks. Discourage consumption of alcohol during nonworking hours, and discourage the intake of coffee during working hours. Monitor for signs of heat stress.

- Acclimate workers to site work conditions by slowly increasing workloads, i.e., do not begin site work with extremely demanding activities.
- Ensure that adequate shelter is available to protect personnel against heat, which can decrease physical efficiency and increase the probability of heat stress. If possible, set up the command post in the shade.

The following are examples of heat-related stress that may be encountered:

- Heat rash is caused by continuous exposure to heat and humid air and aggravated by chafing clothes. Symptoms include a decreased ability to tolerate heat and obvious signs of discomfort.
- Heat cramps are caused by profuse perspiration with inadequate fluid intake and salt replacement. Symptoms include muscle spasm and pain in the extremities and abdomen.
- Heat exhaustion is caused by increased stress on various organs to meet increased demands to cool the body. Signs and symptoms include shallow breathing; pale, cool, moist skin; profuse sweating; dizziness; and lassitude.
- Heat stroke is the most severe form of heat stress. The body must be cooled immediately to prevent severe injury and/or death. Symptoms include red, hot, dry skin; no perspiration; nausea; dizziness and confusion; strong, rapid pulse; and coma.

Heat Stress Monitoring and Work Cycle Management. For field activities that are part of ongoing site work activities in hot weather, the following procedures will be used to monitor the body's physical response to heat and manage the work cycle. These procedures are instituted when the temperature exceeds 70 degrees Fahrenheit.

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Work-rest regimes are based on ambient temperature and level of protective equipment worn. Means are available to measure the physiologic responses to heat stress: heart rate (HR), oral or ear-canal temperature. A Wet-Bulb Globe Temperature (WBGT) index will be calculated for Level D applications. Unfortunately this index is neither valuable nor valid when higher levels of protection are worn. The following physiologic parameters will be used in these cases.

HR is measured by monitoring the radial pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats per minute. If the HR is higher, the next work period is shortened 33 percent, while the length of the rest period stays the same. If the pulse rate still exceeds 110 beats per minute at the beginning of the next rest period, the following work cycle is further shortened by 33 percent. The procedure is continued until the rate is maintained below 110 beats per minute.

Procedures for heat stress monitoring are found in Jacobs' SOP 7-1.

5.5.9.2 Cold Stress

Cold injury (frostbite and hypothermia) and the impaired ability to work are dangers at low temperatures when the wind-chill factor is high. Persons working outdoors in temperatures at or below freezing may become frostbitten. Extreme cold for a short time may cause injury to the surface of the body, or result in profound generalized cooling. Areas of the body that have high surface-area-to-volume ratios such as fingers, toes, and ears, are the most susceptible.

Local injury resulting from cold is included in the generic term frostbite. There are several degrees of damage. Frostbite of the extremities can be categorized in the following manner:

- Frost nip or incipient frostbite: characterized by sudden blanching or whitening of skin.
- Superficial frostbite: skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.

- Deep frostbite: tissues are cold, pale, and solid. These symptoms indicate an extremely serious injury.

Systemic hypothermia is caused by exposure to cool or cold temperatures causing a drop in body core temperatures. Its symptoms include: shivering, apathy, listlessness, sleepiness, cooling of the body core temperature, unconsciousness, glassy stare, slow pulse, and slow respiratory rate.

One or more of the following recommendations will help reduce cold stress:

- Install heaters in the Support Zone and/or onsite trailers to provide a warming area for response personnel.
- Dry coveralls will be available in the event worker clothing becomes wet.
- Provide warm sweet drinks and/or soups at the work site to provide caloric intake and fluid volume. Note, the intake of coffee should be limited because of diuretic and circulatory effects.
- Rotate shifts of workers.
- Carefully schedule work and rest periods.
- Monitor workers' physical conditions.

Procedures for cold stress monitoring are found in Jacobs' SOP 7-2.

5.5.10 Ultraviolet Light

The sun emits ultraviolet (UV) radiation that may be harmful to human skin in excessive amounts. The skin's natural defense mechanisms attempt to reject the UV radiation by distributing melanin pigmentation where needed. However, overexposure to direct sunlight can cause inflammation or blistering of the skin (sunburn). The use of sunscreen barrier creams, long-sleeved shirts, and wide-brimmed hats can help prevent sunburn. Chronic exposure to UV radiation is known to cause skin cancer. In case of sunburn, do not apply burn ointment, cold cream, or butter to relieve pain. Use a dry dressing and get medical attention for severe, blistered, extensive burns.

5.5.11 Adverse Weather

In the event of adverse weather, the Site Manager and HSS/HSO will determine if work can continue without compromising the health and safety of site personnel. Some of the items to be considered before determining if work should continue include the following:

- high winds;
- heavy rainfall or hail;
- potential for heat stress;
- potential for cold stress;
- tornadoes;
- limited visibility;
- electrical storms;
- potential for accidents; and
- the malfunctioning of monitoring equipment.

Electrical storms commonly occur in the Denver region during spring, summer, and fall. The resulting lightning poses a safety hazard to field personnel. Because the storms are often fast moving, field personnel should watch for indications of electrical storms (forecasts should be

covered in the daily health and safety meeting). The distance to an electrical storm can be estimated by observing the interval between the lightning flash and the sound of thunder. Because sound travels approximately 1,100 feet per second, an interval of five seconds corresponds to a storm distance of approximately 1 mile. If an electrical storm is observed within 3 miles of the site, field personnel should cease outside activities and proceed to the site office for further instructions. If caught in the open by an electrical storm, all personnel will immediately seek shelter in their vehicle and proceed as above. In the event that vehicles are inaccessible, personnel will move to a topographically low area away from tall objects and conductors (e.g., transformers, power lines, metal sheds) and wait for the storm to leave the area.

Thunderstorms and Tornadoes. Meteorological conditions will be closely watched, especially in the spring, when severe thunderstorms and tornadoes are most likely to occur. Thunderstorms and tornadoes often occur late in the afternoon on hot spring days, but can occur at any time of the day in any season of the year. Tornadoes are usually preceded by severe thunderstorms with frequent lightning, heavy rains, and strong winds.

A severe thunderstorm watch or a tornado watch announcement on radio or television indicates that a severe thunderstorm or tornado is possible. Work will continue at the work site during severe thunderstorm watches or tornado watches (unless wind exceeds standards or lightning has been identified in the area). A severe thunderstorm warning or a tornado warning signifies that a severe thunderstorm or a tornado has been sighted or detected by radar and may be approaching. All work onsite will cease during a thunderstorm, severe thunderstorm warning, or tornado warning.

Personnel onsite during a tornado will take the following steps:

- Evacuate office trailers or vehicles.
- If outdoors, lie flat in a nearby ditch.
- Stay away from power poles, electrical appliances, and metal objects.

- Do not try to outrun a tornado.

5.5.12 Confined Space Entry

Confined space entries will not be conducted during the nonintrusive portion of this project. A copy of Jacobs' confined space entry procedure is contained in Appendix C.

5.5.13 Lockout/Tagout

Control of employee exposure to hazardous sources of energy during routine operations or servicing and maintenance of equipment, will be accomplished in accordance with 29 CFR 1910.147; EG&G Health and Safety Practice, 1-15320-HSP-2,08, Lockout Tagout; and Jacobs' SOP 8.9, Safety Lock and Tagout.

When occasions arise requiring that lockout/tagout be performed on sources not within Jacobs' control, the EG&G project representative will be contacted for assistance. After application of locks, tags, or use of other controls, under HSP 2.08, Jacobs' health and safety or project management personnel will review the permit and isolations before beginning work. Jacobs' personnel may apply employee locks on isolation points as necessary.

Lockout/tagout of hazardous energy sources under Jacobs' control will be done in accordance with Jacobs' SOP 8.9.

5.5.14 Excavations

Trenching or excavating are not anticipated during the course of work covered under the plan. If they become necessary through revisions to work scope, the following practices will be observed:

- All trenches and excavations will be shored, sloped, or benched in accordance with 29 CFR 1926, Subpart P, and EG&G Rocky Flats, Health and Safety Practice, HSP - 12.08, Excavations and Trenching (HSP, 12.08).
- All open trenches and excavations will be inspected initially after installation of protective shoring, sloping, or benching, and daily thereafter to ensure that degradation of soil conditions or protection is promptly addressed. Personnel will not be allowed into trenches and excavations before inspections. Any required air monitoring will be conducted in conjunction with daily inspections.
- Standing water will be removed before entry by personnel and will not be allowed to accumulate during the course of work.
- Ladders will be installed into trenches and excavations 4 feet or more in depth, at intervals not to exceed 25 feet.
- All trenches and excavations will be marked with warning devices or barricades.
- Loose soil and rock will be kept at least 2 feet from the edges of trenches and excavations. Scaling of loose material will be done in conjunction with the daily inspections.

5.5.15 Pressure Safety

At the time of HSP preparation, a work scope that would determine pressure-testing requirements for tanks, vessels, and process piping has not been defined by the contractor. If this work becomes necessary, Jacobs will use the following approach to ensure worker health and safety:

- The work will be performed by a professional engineering group with demonstrated experience in the field.

- The safety record and health and safety program will be reviewed before beginning work.
- Procedures governing the testing methodology will be reviewed to ensure compliance with American Society of Mechanical Engineers (ASME), American Society for Testing and Materials (ASTM), and OSHA requirements. These procedures will also delineate safety and health requirements to prevent injury to personnel.
- In the event that procedures are nonexistent or inadequate to provide for worker safety, a JSA will be generated and provided for review. The analysis will cover basic tasks to be completed, the hazards associated with each task, and the methods to be used in controlling each hazard. Vessel containment, overpressure relief, and protection of employees from shrapnel must be addressed as part of each analysis. Destructive testing is not anticipated.
- This HSP will be amended before pressure testing is conducted to reflect specific controls.

5.5.16 Illumination

All operations will be conducted during daylight hours. If circumstances require work to be performed during periods of diminished lighting or darkness, artificial lighting will be used. Lighting will be of sufficient quantity to provide a minimum of five foot-candles in the work area(s) in accordance with 29 CFR 1926.56.

5.6 BIOLOGICAL HAZARDS

The following biological hazards that may be encountered at RFP are discussed in this section: (1) poisonous plants, (2) insects and ticks, (3) poisonous snakes, and (4) scorpions.

5.6.1 Poisonous Plants

Poison ivy, poison oak, and poison sumac may be encountered at RFP. These plants may be found in low-lying areas, wetlands, ditches, and creeks.

5.6.1.1 Poisonous Plant Avoidance Procedures

Poison ivy, poison oak, and poison sumac are identified by three or five leaves radiating from a stem. Poison ivy is a vine; poison oak and sumac are bush-like. The plant tissues have an oleoresin that is active in live, dead, and dried parts. The oleoresin may be carried via smoke, dust, contaminated clothing, and animal hair.

5.6.1.2 First Aid for Poisonous Plants

Signs and symptoms include redness, swelling, and sometimes intense itching. Blisters form during the subsequent 24 hours. Crusting and scaling occurs within a few days. In the absence of complications, healing is complete in about 10 days. Wash any exposed skin with mild soap and water, but do not scrub the area.

5.6.2 Insects and Ticks

A variety of insects and ticks may be encountered at RFP. Caution needs to be taken when encountering insects and ticks during field activities.

5.6.2.1 Ants, Bees, Wasps, and Hornets

Stings of these insects are responsible for more deaths in the United States than bites and stings of all other venomous creatures combined. These deaths result from sensitization by the victim to the venom, which can result in anaphylactic reactions upon subsequent stings. The stinger may remain in the skin and should be removed by scraping rather than pulling. An ice cube

placed over the sting will reduce pain. An analgesic-corticosteroid lotion is often useful. People with known hypersensitivity to such stings should carry a kit containing an antihistamine and epinephrine.

5.6.2.2 Ticks and Lyme Disease

Lyme disease is an illness caused by a bacterium that may be transmitted through the bite of the tick *Ixodes dammini*, commonly referred to as the deer tick. Not all ticks are infected with the bacterium; however, when an infected tick bites, the bacterium is passed into the bloodstream of the host where it multiplies. The deer tick is commonly found onsite living in grassy and wooded areas feeding on mammals such as mice, raccoons, deer, and humans.

The illness typically occurs in the summer and is characterized by a slowly expanding red rash that develops in a few days to a few weeks after the bite of an infected tick. This rash may be accompanied by flu-like symptoms along with a headache, stiff neck, fever, muscle aches, and/or general malaise. At this stage, treatment by a physician usually is effective. If left alone, these early symptoms may disappear but more serious problems may follow. Other problems that may occur include meningitis, neurological abnormalities, and cardiac abnormalities. It is important to note that some people do not get the characteristic rash and may have diminished progress to the latter manifestations. Treatment of later symptoms is more difficult than early symptoms and is not always successful.

Tick Avoidance. When in an area suspected of harboring ticks (grass, brushes, woodland), the following precautions can minimize the chances of being bitten:

- Wear light-colored clothing so ticks can be easily spotted.
- Wear tick repellent.

- Inspect clothing frequently while in tick habitat paying special attention to the insides of seams and cuffs.
- Do not pick up dead mammals.

The procedure for performing first aid for tick bites is to inspect your head and body thoroughly when returning from the field. Removal of ticks is best accomplished using small tweezers. Do not squeeze the tick's body. Grasp it where the mouth parts enter the skin and tug gently, but firmly, until it releases its hold on the skin. Wipe the bite thoroughly with an antiseptic and seek medical attention if needed.

5.6.2.3 Spiders

Almost all of the 30,000 species of spiders are venomous, but only a relatively small number have fangs long and strong enough to penetrate the human skin. Spiders are generally found in dark protected areas such as access ways to sanitary sewers, under ledges, in protective casings of monitoring wells, pump houses, buildings, portable toilets, and manhole covers. The black widow spider ranges in color from gray to brown to black, depending on the species. The abdomen is shiny black with a red hourglass or red spots. Although both male and female are venomous, only the latter has fangs large and strong enough to penetrate the human skin. Mature females range in body length from 10 to 18 millimeters (mm).

The person who is bitten may recall receiving a sharp, pinprick-like bite, but in some cases, the bite is so minor that it goes unnoticed. Rarely is there any local skin reaction. The initial pain is sometimes followed by a dull, occasionally numbing pain in the affected extremity, and by pain and cramps in one or several of the large body muscles. Sweating and weakness are common, as well as varying degrees of headache and dizziness. The lymph nodes in the region of the bite will often be tender or painful. In severe cases, there is rigidity of the abdominal muscles and pain in the lower back, thighs, or abdomen. There is no effective first aid treatment. Treat for shock and transport to the nearest medical facility.

The brown recluse or violin spider has an abdomen that ranges in color from grayish to orange and reddish-brown to dark brown. The back shell of the "violin" is brown to black and distinct from the pale yellow to reddish-brown background of the head and chest. This spider has six eyes grouped in three dyad. Both male and female are venomous. They average 6 to 12 mm in body length. The bite of this spider produces about the same degree of pain as the sting of an ant. In most cases, a localized burning sensation develops that may last for 30 to 60 minutes. The area often itches, becomes red and warm, with a small blanched area around the immediate bite site. The reddened area enlarges and becomes purplish during the subsequent one to eight hours. A small blister forms at the bite site, increases in size, and may rupture. The whole area may become swollen and painful. Other signs and symptoms include fever, malaise, stomach cramps, nausea, and vomiting. In severe cases, there may be breakdown of the red blood cells, renal failure, or death. All first aid measures should be avoided as the natural appearance of the bite is most important in determining the diagnosis. A cube of ice may be placed on the wound, and medical attention should be sought.

The procedure for performing first aid for spider bites is to apply ice to the bite area and keeping that area below the heart level to slow circulation of the venom. The individual should seek medical attention.

5.6.3 Poisonous Snakes

The most frequently observed reptiles at RFP are bull snakes and rattlesnakes. Eastern yellow-bellied racers have also been seen. Western plains garter snakes are found in and around many of the ponds.

5.6.3.1 Snake Recognition and Avoidance Procedure

Of the mentioned reptiles, rattlesnakes are the only poisonous variety. To help identify a potentially poisonous snake from a nonpoisonous snake, descriptions of both species are presented.

General Description. Rattlesnakes have a triangular-shaped head with vertical pupils and typically have a blotched/camouflage pattern on their back. They have distinctive "buzz" made by rattling their tail. Rattlesnakes will not always rattle before striking.

Nonpoisonous snakes have an oblong-shaped head with round pupils. Typically, nonpoisonous snakes are a uniformly dark solid color or solid color with stripes running lengthwise down the body. The one exception at RFP is the bull snake. Bull snakes mimic rattlesnakes in appearance and are capable of "rattling" their tail, but are nonpoisonous and do not have a triangular-shaped head or vertical pupil.

The best procedure for avoiding snakes is to be familiar with snake habitat and observant in the field. Snakes can be found under debris, manhole covers, or overgrown vegetation. Personnel will be especially careful walking at night or in grass and underbrush. Do not climb rocky ledges without first visually inspecting them. Wear boots and heavy pants because more than half of all bites are on the lower parts of the legs. Do not attempt to kill snakes unnecessarily; many people are bitten in such an attempt.

5.6.3.2 First Aid for Snakebites

All reactions from snakebites are aggravated by acute fear and anxiety. The severity of local and general reaction from poisonous snakebites depends upon the amount of venom injected and the speed of absorption of venom into the victim's circulation, the size of the victim, the protection from clothing, the speed at which antivenom therapy can be provided, and the location of the bite.

The extremely painful characteristics of a rattlesnake bite include rapid swelling that can be identified by one or more puncture wounds created by the fangs. The skin is usually marked with general discoloration. Symptoms may include general weaknesses, rapid pulse, nausea and vomiting, shortness of breath, dimness of vision, and shock.

There are three objectives in administering first aid for snake bites. The first is to reduce the circulation of blood through the bite area, the second is to delay the absorption of the venom, and the third is to prevent aggravation of the local wound and to sustain respiration.

Emergency treatment does not include incision through the fang marks. Typically, more harm than good is done this way. Immobilize the person and the bite wound in a horizontal position. Wash the bite with water, but avoid manipulation of the bite area. Do not allow the person to walk, run, or drink alcoholic beverage or stimulants (soda or coffee). Do not apply ice or give aspirin. Treat for shock and transport to the nearest medical facility.

5.6.4 Scorpion Avoidance Procedure and First Aid for Stings

Scorpions may also be found at RFP. The best procedures for avoiding scorpions are to be (1) familiar with scorpion habitat, and (2) observant in the field. Scorpions can be found under debris, manhole covers, or overgrown vegetation. Personnel will be especially careful walking at night or in grass and underbrush. Do not climb rocky ledges without first visually inspecting them. Wear boots and heavy pants because more than half of all bites are on the lower parts of the legs.

A sting will cause persistent pain, numbness, and tingling. Signs and symptoms may include local pain, rash, redness, blisters, headache, and fever. If the scorpion stinger remains embedded, remove the stinger with tweezers or by scraping with a credit card. Wash area with soap and water and apply cold packs to the affected area. Treat for shock and transport to the nearest medical facility.

5.7 HAZARD COMMUNICATION PROGRAM PROCEDURES

All field personnel will receive hazard communication training before beginning work. The goal of the program is to provide employees with the knowledge to work safely, be aware of potential hazards, and be able to implement appropriate precautions when working with hazardous

chemicals. Training will comply with the OSHA Hazard Communication Standard, 29 CFR 1910.1200, and will include the following topics:

- a review of employees right to know and the location of hazardous material information onsite (e.g., MSDSs and hazard labels);
- a review of how to interpret MSDSs and hazard labels;
- a review of site operations and the hazardous chemical products associated with each operation;
- a review of safety and health hazards present on the site;
- methods for detecting hazards;
- control measures and emergency procedures for employee protection; and
- a review of the site HSP.